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A Fish Habitat Survey Of The Jacquet River Watershed, Restigouche County, N.B. Volume 2: Water and Sediment Chemistry Data

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by

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ABSTRACT

Legault, J.A., 1989. A Fish Habitat Survey of the Jacquet River Watershed, Restigouche County, N.B. Volume 2 Water and Sediment Chemistry Data. Can. Data Rep. Fish. Aquat. Sci. 724 (Vol.2), 47p.

This report, Volume 2 of a four volume series, is a compilation of water and sediment data for the Jacquet River watershed collected during August, 1984. General nutrient and metal data are presented. Other topics are :

Volume 1 - Hydraulic and Physiographic Data
Volume 3 - Estimated Fish Densities and Biological Data for Salmonid Specimens
Volume 4 - Species Composition and Relative Abundance of Benthic Macro-invertebrates

RESUMÉ

Legault, J.A., 1989. A Fish Habitat Survey of the Jacquet River Watershed, Restigouche County, N.B. Volume 2 Water and Sediment Chemistry Data. Can. Data Rep. Fish. Aquat. Sci. 724 (Vol.2), 47p.

Ce rapport, le deuxième d'une série de quatre volumes, consiste d'une compilation de données se rapportant à l'eau et aux sédiments de la ligne de partage des fonds de la rivière Jacquet en août 1984. Des données générales de nutriments et de métaux sont présentées. D'autres sujets sont:

Volume 1 - Hydraulic and Physiographic Data
Volume 3 - Estimated Fish Densities and Biological Data for Salmonid Specimens
Volume 4 - Species Composition and Relative Abundance of Benthic Macro-invertebrates

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INTRODUCTION

The Jacquet River, a medium-sized salmon stream approximately 50 km in linear extent in Restigouche Co., New Brunswick contains ideal spawning and rearing habitat for Atlantic Salmon *(Salmo salar)*. With the exception of logging activity, the watershed is largely undeveloped. In 1965, Brunswick Mining and Smelting, Ltd. installed a water intake structure approximately 2 km from the mouth of the Jacquet River. They are presently operating on a water license from the New Brunswick Department of Municipal Affairs and Environment (formerly the Dept. of Fisheries and Environment). This license, renewed in 1974, expired in 1979 and has not since been formally renewed. The license permits a withdrawal of a maximum of 39312 cu. meters/day for consumption in the lead smelter and the fertilizer plant as well as for domestic use in two adjacent town sites in Belledune.

Five previous studies of the river have been undertaken within the last twenty years. Three were qualitative in scope offering visual descriptions of available habitat and fish present (Smith 1956, N.B.D.N.R.(unpublished 1969 report), and IEC Beak 1984). Two studied the microhabitat requirements of salmon in the area downstream from the water intake station (Morantz 1983, IEC Beak 1982).None of these studies presented quantitative data for water or sediment quality or hydrology.

Low stream discharges have a potential negative impact on adult salmon. This is related to reduced attraction flows, impediments to migration, and greater exposure to poaching (IEC Beak, 1982). Survival of salmon parr is also threatened by low flows, particularly in summer when territories are being defended and metabolic demands are higher. It has been determined that the minimum maintenance flow requirement for the Jacquet River is 97,600 cu. meters per day. (Morantz, 1983). However, records for 1965 to 1976 show that flows less than 86,000 cu. meters per day are common for periods of three to seven days and occur for a period of thirty days or more once every six years. Withdawal of any water under these low flow conditions will result in loss of fish habitat. Withdrawal of water at the maximum rate allowed under conditions of low flow "would result in a drastic habitat loss in the stream reach below the pumphouse." (Morantz, 1983) Despite these extremes, water withdrawal is estimated to average 21,600 cu. meters per day. Withdrawal of this volume under normal flow conditions results in habitat losses ranging from 8% to greater than 22%. (Morantz, 1983)

In August, 1984, the Gulf Region's Fish Habitat Division conducted a survey on the Jacquet River to determine site-specific baseline conditions for hydrology, water and sediment chemistry, fish and macro-invertebrate populations, and assess the general habitat quality of the watershed. The area of study consisted of 24 sites along the main stem of the river and seven of its major tributaries: Big Hole Brook, Antinouri Lake Brook, Lower South Branch, Lower McNair Brook, Upper South Branch, Upper McNair Brook and Rocky Brook. This report, the second in a series of four data reports, presents the water and sediment chemistry data collected on this survey.

METHODS AND MATERIALS

Sampling of water for chemical analysis was performed immediately upstream of the sites selected for biological and hydrologic analysis. Water temperature, conductivity, pH and dissolved oxygen were measured on site using a Hydrolab meter (model #4041) equipped with a multi-probe sonde. Turbidity was also measured on site using a field turbidimeter (H.F.Instruments, model DRT-15). Nutrient chemistry samples were collected in pre-washed 500 ml plastic bottles (for total nitrogen and silica and dissolved organic carbon) and 50 ml glass bottles (for total phosphorus). Sample bottles were supplied by Inland Waters Directorate, Water Quality Branch Environment Canada, the agency responsible for a greater part of the chemical analysis in this report. Samples for dissolved metals (Iron, copper, lead, zinc, cadmium, and arsenic) were collected using acid-washed 500 ml plastic bottles. These samples were acid-preserved on-site with 5 mls ultra pure (Ultrex brand) sulfuric acid.

All water samples were collected by hand at locations as close to mid-stream as possible. Each bottle was rinsed three times with the river water before the sample was taken. Samples for total phosphorus were poured off from the plastic bottles into the glass bottles. Replicate samples for dissolved metals were taken at most sites and ordinarily multiple Hydrolab readings were taken at separate stations within the site. All water samples were then stored on ice for transport and kept refrigerated until analyzed.

Sediment samples were taken from exposed mud/silt reaches from the banks of the river. The samples were scooped into rinsed bottles using the lid and filled as complete as possible. These were sealed with the bottle caps and kept cool for transport. The sediment samples were then frozen until analyzed. The sediments were analyzed for organic carbon, total carbon, moisture, and the following metals: copper, lead, zinc, cadmium, and mercury. The sediments were also analyzed for the presence of Fenitrothion, a pesticide used commonly in this watershed for control of the Spruce Budworm in softwood stands.

ANALYSES

Dissolved nutrients (nitrogen, silica, phosphorus and dissolved organic carbon) were analyzed within 6 weeks of sampling by the Inland Waters Directorate Water Quality Branch, D.O.E. in Moncton, N.B. using the standard methods described in their Analytical Methods Manual (1979). Dissolved metals (iron, copper, lead, zinc, cadmium, and arsenic) were analyzed within 4 weeks of sampling at Brunswick Mining and Smelting Company laboratory in Belledune, N.B. using Greenberg et. al. (1975) All metals except arsenic were pre-concentrated and determined by Atomic Absorption. Arsenic was analyzed by hydride evolution and determined by colorimetry. Collected sediments were analyzed for copper, lead, zinc, cadmium, mercury and Fenitrothion by the Environmental Protection Services Labs, Dartmouth, Nova Scotia using their standard methods manual (EPS 1973). Sediment carbon, organic carbon and percent moisture were determined by the Nova Scotia Research Foundation using the standards methods manual (EPS 1973).

RESULTS

The results of the analyses are presented on a site by site basis in the following tables. All results are expressed in milligrams per liter (mg/l) except for temperature (°C), conductivity (µS/cm - micro Siemens per cm), Turbidity (NTU - Nephelometric Turbidity Units), Percent moisture and pH units. Replicate readings and samples are presented without averaging. Maps were drawn from aerial photographs at a 1:8000 scale for each site. Locations of the water and sediment sampling sites were added from hand drawn sketches made during the sampling survey.

ACKNOWLEDGEMENTS

Special thanks are extended to Larry D. Haight for the preparation of the maps.

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FIG. 2.1 LOCATION OF SAMPLING SITES, JACQUET RIVER WATERSHED, AUGUST 1984

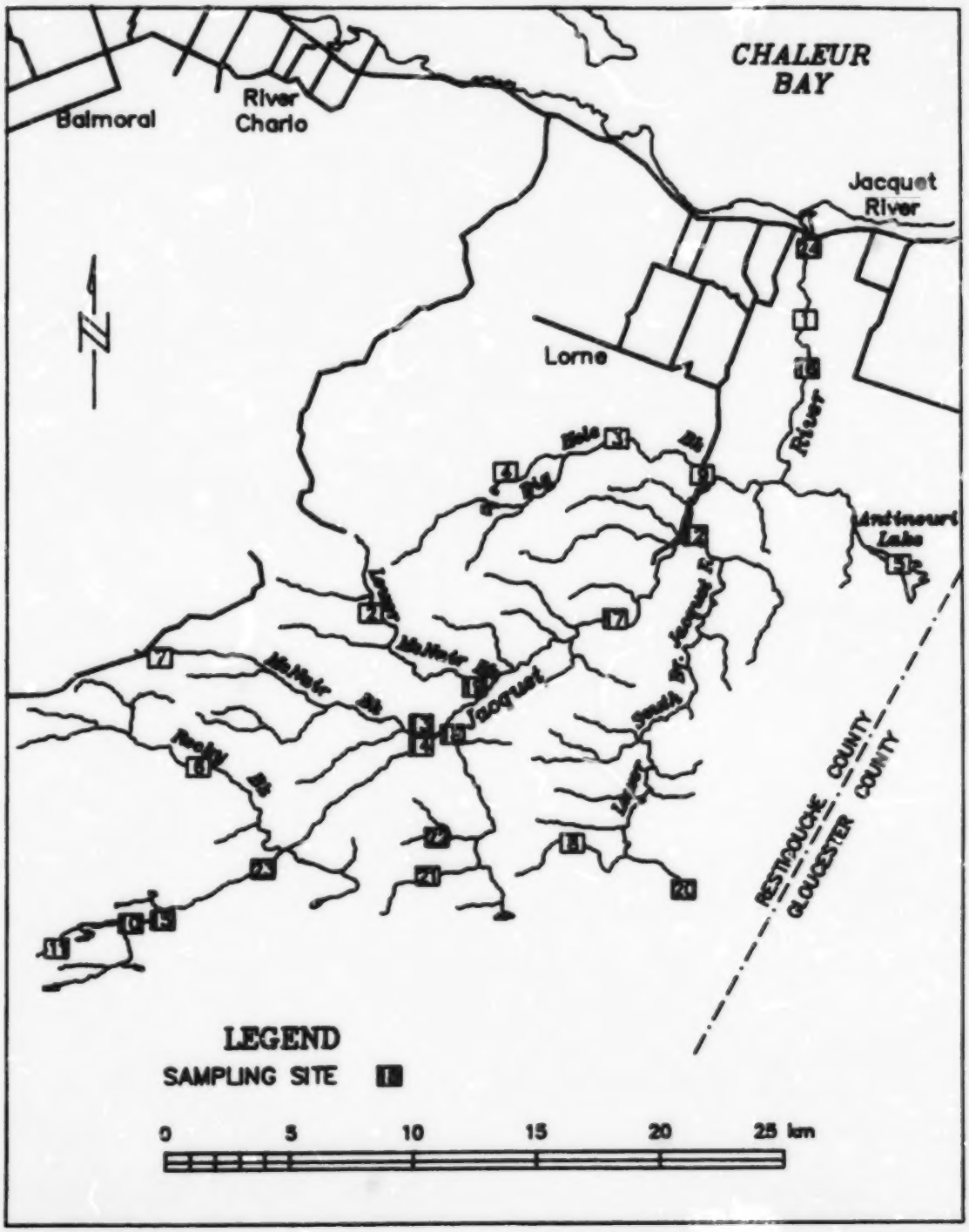
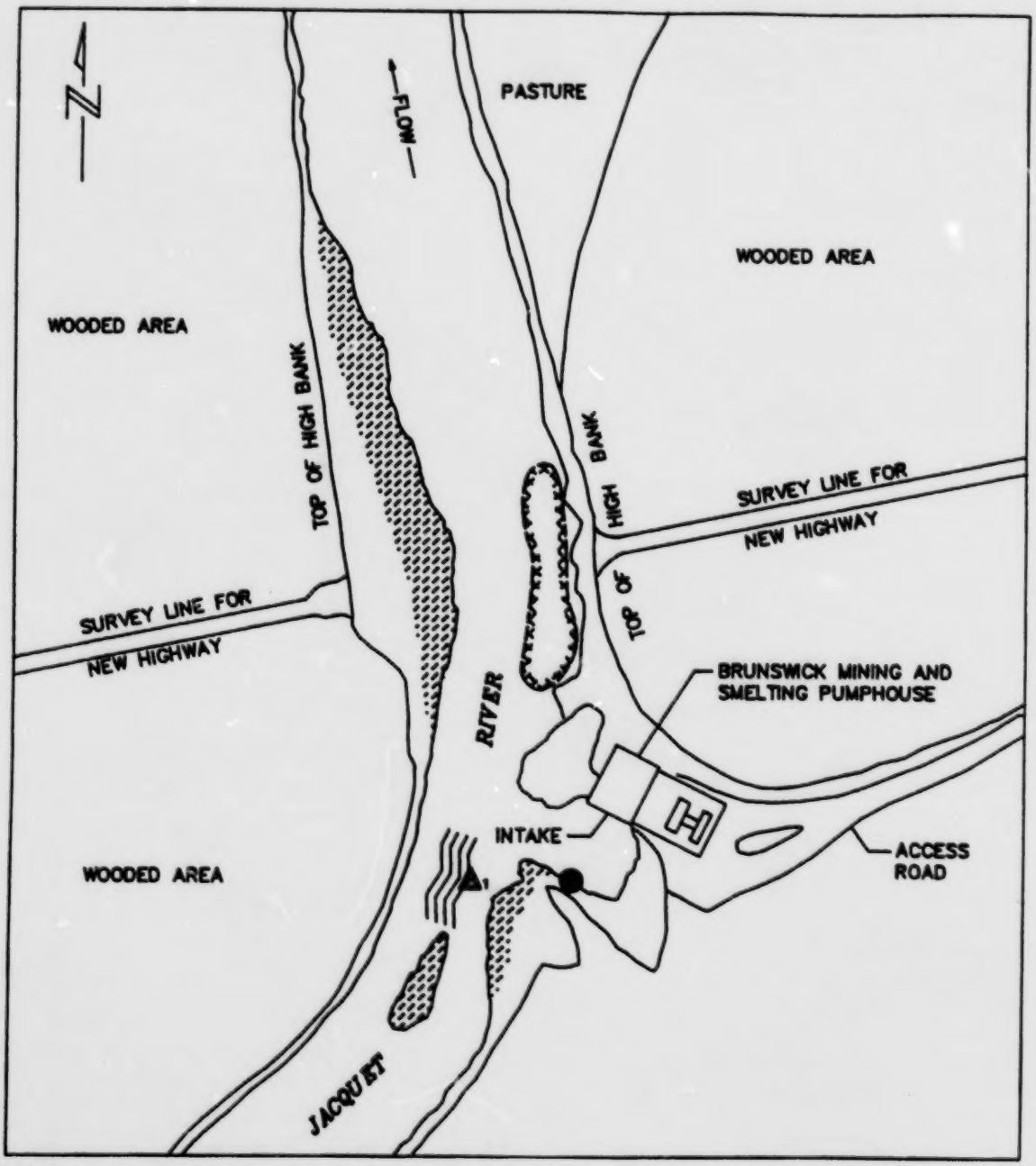


FIG. 2.2 LOCATION OF CHEMISTRY SAMPLING STATIONS, SITE 1, JACQUET RIVER, AUGUST 9,1984



LEGEND

- A_2 WATER CHEMISTRY SAMPLING STATION
- SEDIMENT SAMPLING STATION
- RIFFLE AREA
- POOL
- BARRIER
- GRAVEL

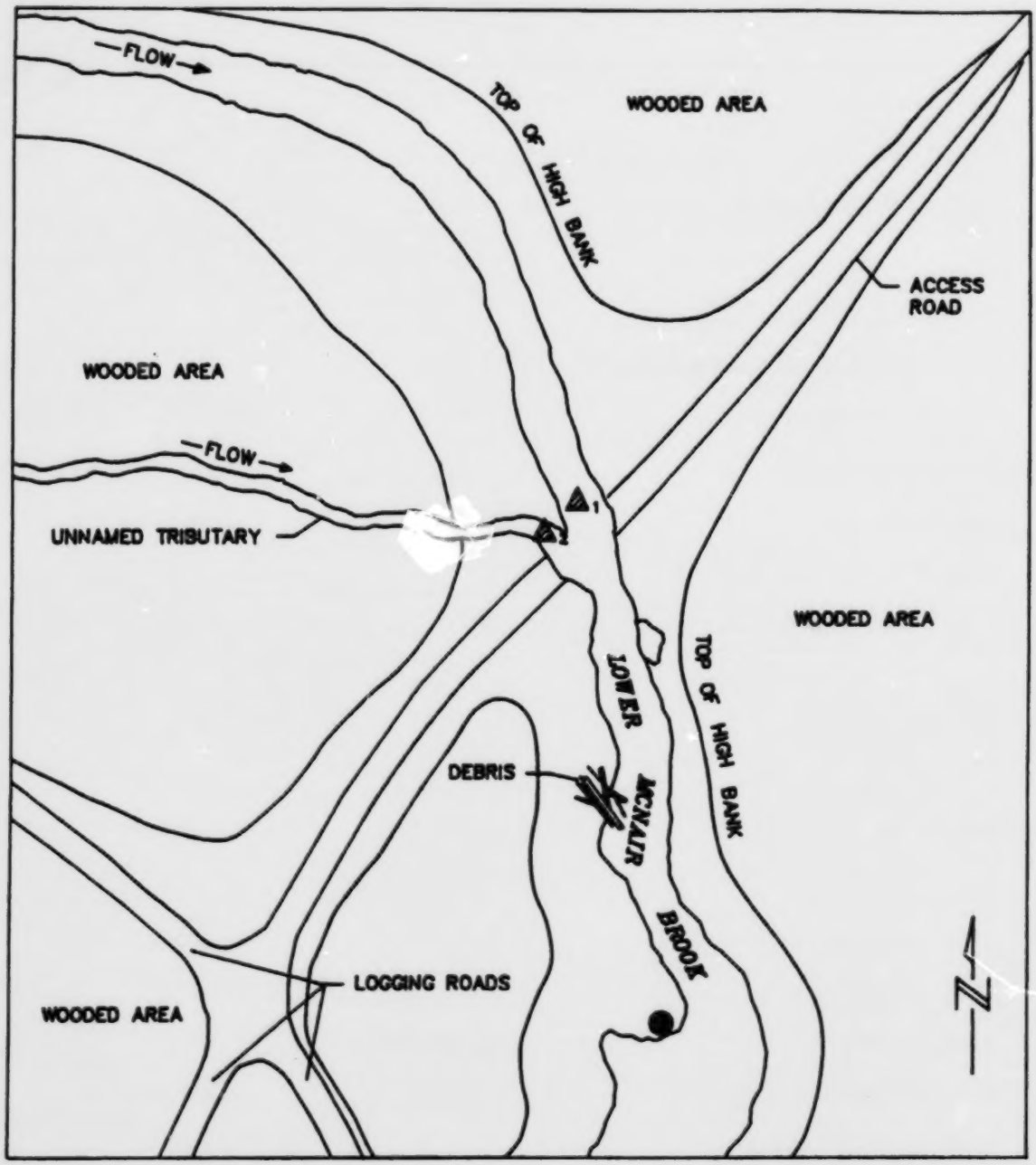
SCALE 0 10 20 m (APPROX.)
TOPOGRAPHIC MAP 21-O/16
MILITARY GRID 223 093

Table 2.1 Water and sediment analyses,
Site 1, Jacquet River, August 9, 1984.

Parameter	Water Sample No.			Sediments
	1	2	3	1
Temperature (°C)	18.9	19.0		
Dissolved oxygen (mg/l)	9.3			
Conductivity (µS/cm)	98	80		
pH	7.4	7.6		
Turbidity (ntu.)	0.21			
Dissolved organic carbon (mg/l)	3.70			
Organic Carbon (mg/l)				9.9
Carbon (mg/l)				20.3
Moisture (%)				1.46
Dissolved nitrogen (mg/l)	0.10			
Total nitrogen (mg/l)	0.18			
Total phosphorous (mg/l)	0.002	0.002		
Silica (mg/l)	8.70			
Iron (mg/l)	0.038	0.028		
Copper (mg/l)	<0.001	<0.001		18.2 *
Lead (mg/l)	<0.002	<0.002		<2.0 *
Zinc (mg/l)	0.164	0.022		126.0 *
Cadmium (mg/l)	<0.001	<0.001		0.20 *
Arsenic (mg/l)	<0.002	<0.002		
Mercury (mg/l)				0.04 *
Fenitrothion (mg/l)				<0.005 *

* - sediment analysis expressed as µg/g dry weight

FIG. 2.3 LOCATION OF CHEMISTRY SAMPLING STATIONS, SITE 2, LOWER MCNAIR BROOK, AUGUST 10,1984



LEGEND

- $\blacktriangle_2$ WATER CHEMISTRY SAMPLING STATION
- ● SEDIMENT SAMPLING STATION
- RIFFLE AREA
- POOL
- BARRIER
- GRAVEL

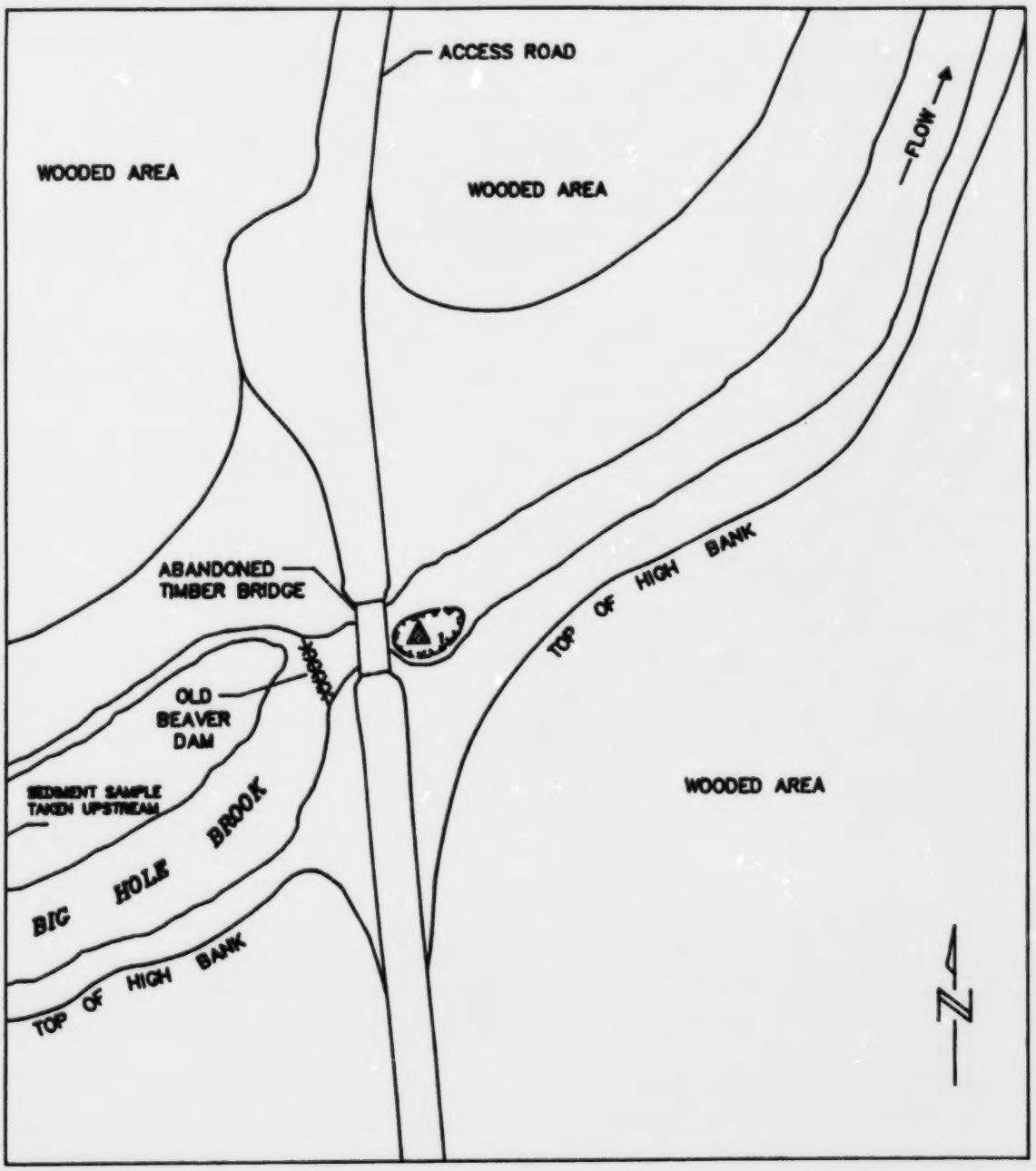
SCALE 0 10 20 m (APPROX.)
TOPOGRAPHIC MAP 21-O/16
MILITARY GRID 052 956

Table 2.2 Water and sediment analyses,
Site 2, Lower McNair Brook, August 10, 1984.

Parameter	Water Sample No.			Sediment
	1	2	3	1
Temperature (°C)	16.7	14.10		
Dissolved oxygen (mg/l)	9.1	8.7		
Conductivity (µS/cm)	64	56		
pH	7.0	6.7		
Turbidity (ntu.)	0.16			
Dissolved organic carbon (ppm)				
Organic carbon (mg/l)				233.2
Carbon (mg/l)				342.9
Moisture (%)				21.12
Dissolved nitrogen (mg/l)				
Total nitrogen (mg/l)				
Total phosphorous (mg/l)	0.008			
Silica (mg/l)				
Iron (mg/l)	0.070	0.068		
Copper (mg/l)	<0.001	<0.001		7.4 *
Lead (mg/l)	<0.002	<0.002		<2.0 *
Zinc (mg/l)	0.104	0.067		75.7 *
Cadmium (mg/l)	<0.001	<0.001		0.3 *
Arsenic (mg/l)	<0.002	<0.002		
Mercury (mg/l)				0.04 *
Fenitrothion (mg/l)				<0.005 *

* - sediment analysis expressed as µg/g dry weight

FIG. 2.4 LOCATION OF CHEMISTRY SAMPLING STATIONS, SITE 3, BIG HOLE BROOK, AUGUST 11,1984



LEGEND

- A_2 WATER CHEMISTRY SAMPLING STATION
- SEDIMENT SAMPLING STATION
- RIFFLE AREA
- POOL
- BARRIER
- GRAVEL

SCALE 0 5 10 15 m (APPROX.)
TOPOGRAPHIC MAP 21-O/16
MILITARY GRID 139 019

Table 2.3 Water and sediment analyses,
Site 3, Big Hole Brook, August 11, 1984.

Parameter	Water Sample No.			Sediment
	1	2	3	1
Temperature (°C)	20.0	20.0		
Dissolved oxygen (mg/l)	8.2	8.7		
Conductivity (µS/cm)	83	67		
pH	7.1	7.3		
Turbidity (ntu.)	0.06			
Dissolved organic carbon (mg/l)	4.8			
Organic carbon (mg/l)				58.6
Carbon (mg/l)				203.4
Moisture (%)				22.63
Dissolved nitrogen (mg/l)	0.02			
Total nitrogen (mg/l)	0.11			
Total phosphorous (mg/l)	0.006			
Silica (mg/l)	9.0			
Iron (mg/l)	0.044	0.044		
Copper (mg/l)	<0.001	<0.001		9.3 *
Lead (mg/l)	<0.002	<0.002		<2.0 *
Zinc (mg/l)	0.017	0.025		83.6 *
Cadmium (mg/l)	<0.001	<0.001		0.4 *
Arsenic (mg/l)	0.002	<0.002		
Mercury (mg/l)		<0.025 *		
Fenitrothion (mg/l)		<0.005 *		

* - sediment analysis expressed as µg/g dry weight

FIG. 2.5 LOCATION OF CHEMISTRY SAMPLING STATIONS, SITE 5, ANTINOURI LAKE, AUGUST 12,1984

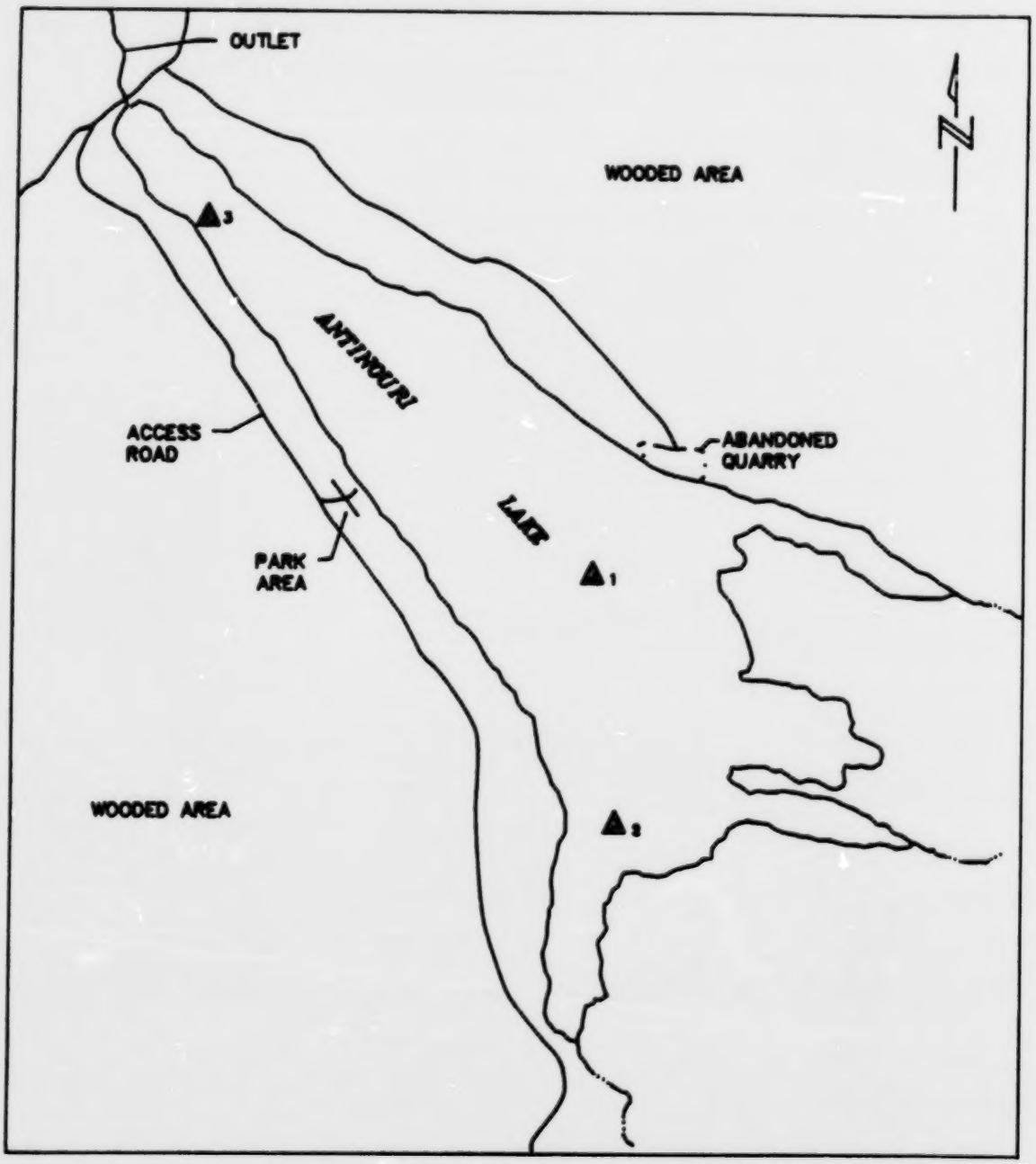
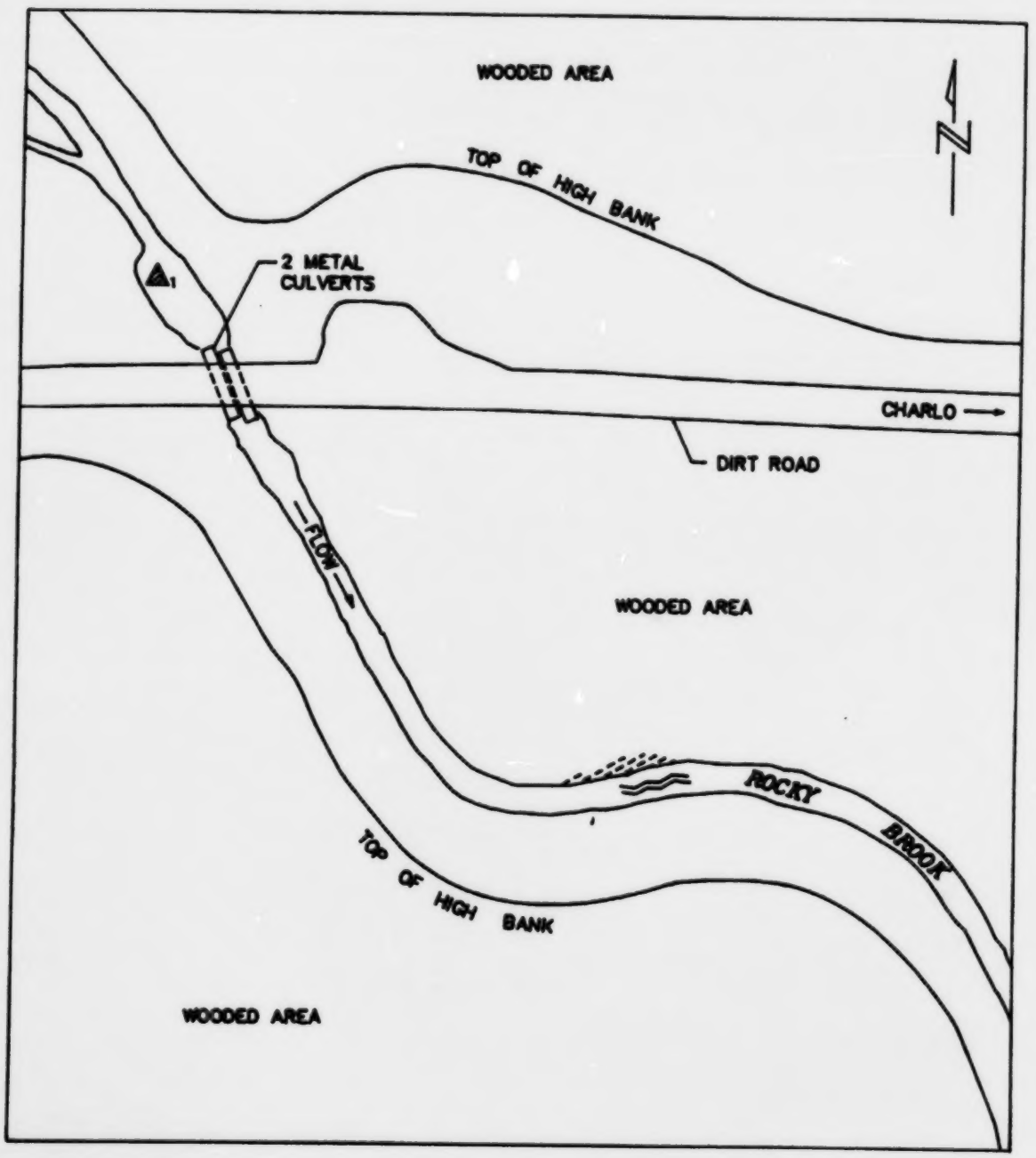


Table 2.4 Water and sediment analyses,
Site 5, Antinouri Lake, August 18, 1984.

Parameter	Water Sample No.			Sediment
	1	2	3	1
Temperature (°C)	22.4	22.5	21.7	
Dissolved oxygen (mg/l)	7.8	7.8	7.9	
Conductivity (µS/cm)	23	23	22	
pH	6.1	5.9	5.9	
Turbidity (ntu.)		0.31		
Dissolved organic carbon (mg/l)	4.4			
Organic carbon (mg/l)				
Carbon (mg/l)				
Dissolved nitrogen (mg/l)	0.04			
Total nitrogen (mg/l)	0.13			
Total phosphorus	0.008			
Silica (mg/l)	9.3			
Iron (mg/l)	0.022	0.022		
Copper (mg/l)	<0.001	<0.001		
Lead (mg/l)	<0.002	<0.002		
Zinc (mg/l)	0.040	0.017		
Cadmium (mg/l)	<0.001	<0.001		
Arsenic (mg/l)	0.002	<0.002		
Mercury (mg/l)				
Fenitrothion (mg/l)				

FIG. 2.6 LOCATION OF CHEMISTRY SAMPLING STATIONS, SITE 6, ROCKY BROOK, AUGUST 14,1984



LEGEND

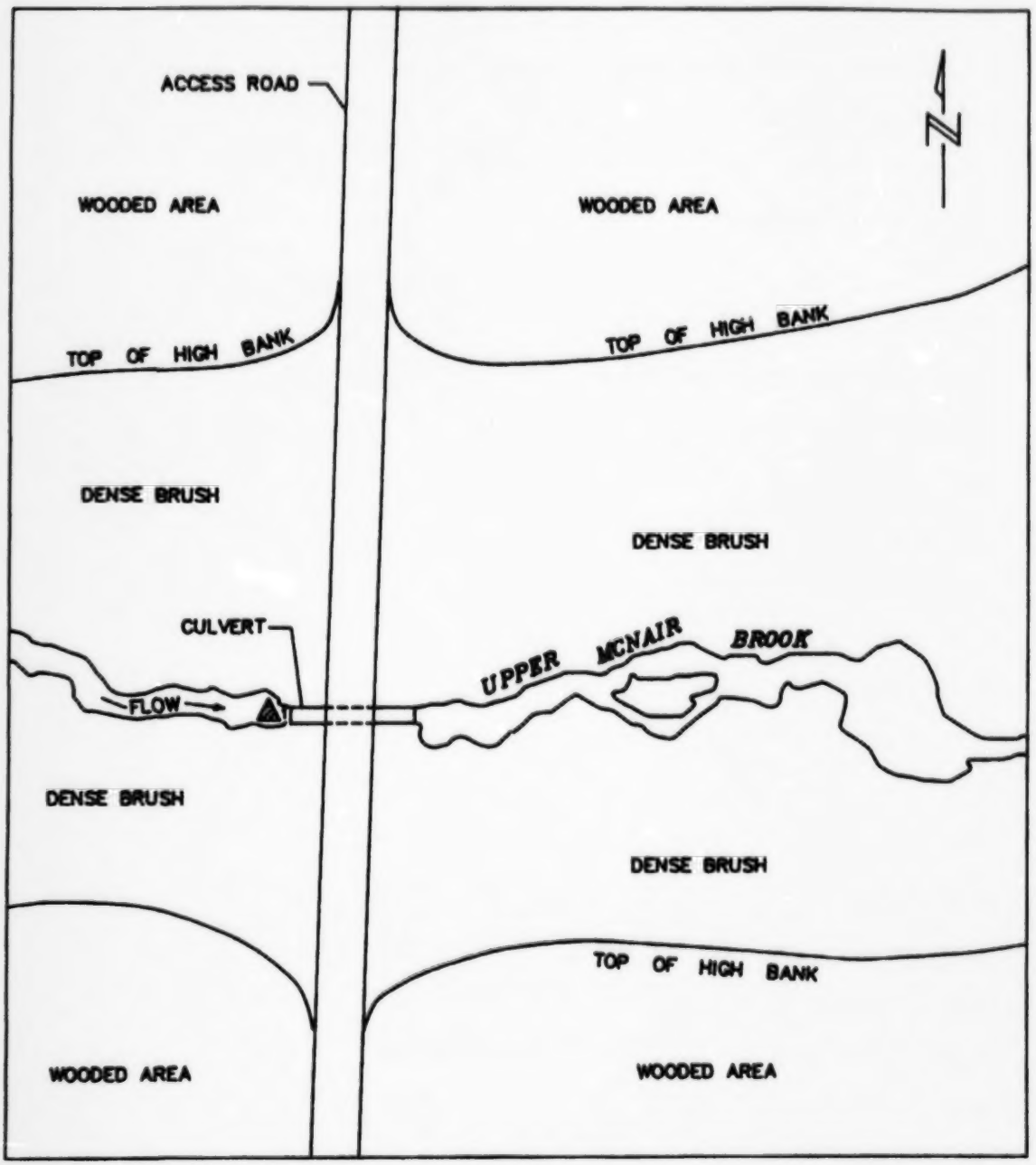
- A_2 WATER CHEMISTRY SAMPLING STATION
- SEDIMENT SAMPLING STATION
- RIFFLE AREA
- POOL
- BARRIER
- GRAVEL

SCALE 0 10 20 m (APPROX.)
TOPOGRAPHIC MAP 21-O/9
MILITARY GRID 986 885

Table 2.5 Water and sediment analyses,
Site 6, Rocky Brook, August 14 , 1984 .

Parameter	Water Sample No.			Sediment
	1	2	3	1
Temperature (°C)	17.6			
Dissolved oxygen (mg/l)	9.1			
Conductivity (µS/cm)	58			
pH	6.9			
Turbidity (ntu.)				
Dissolved Organic Carbon (mg/l)	2.8			
Organic carbon (g/kg)				
Carbon (g/kg)				
Moisture (%)				
Dissolved nitrogen (mg/l)	<0.01			
Total nitrogen (mg/l)	0.10			
Total phosphorous (mg/l)	0.010			
Silica (mg/l)	1.4			
Iron (mg/l)	0.224	0.232		
Copper (mg/l)	<0.001	<0.001		
Lead (mg/l)	<0.002	<0.002		
Zinc (mg/l)	0.054	0.023		
Cadmium (mg/l)	<0.001	<0.001		
Arsenic (mg/l)	<0.002	<0.002		
Mercury (mg/l)				
Fenitrothion				

FIG. 2.7 LOCATION OF CHEMISTRY SAMPLING STATIONS, SITE 7, UPPER MCNAIR BROOK, AUGUST 14,1984



LEGEND

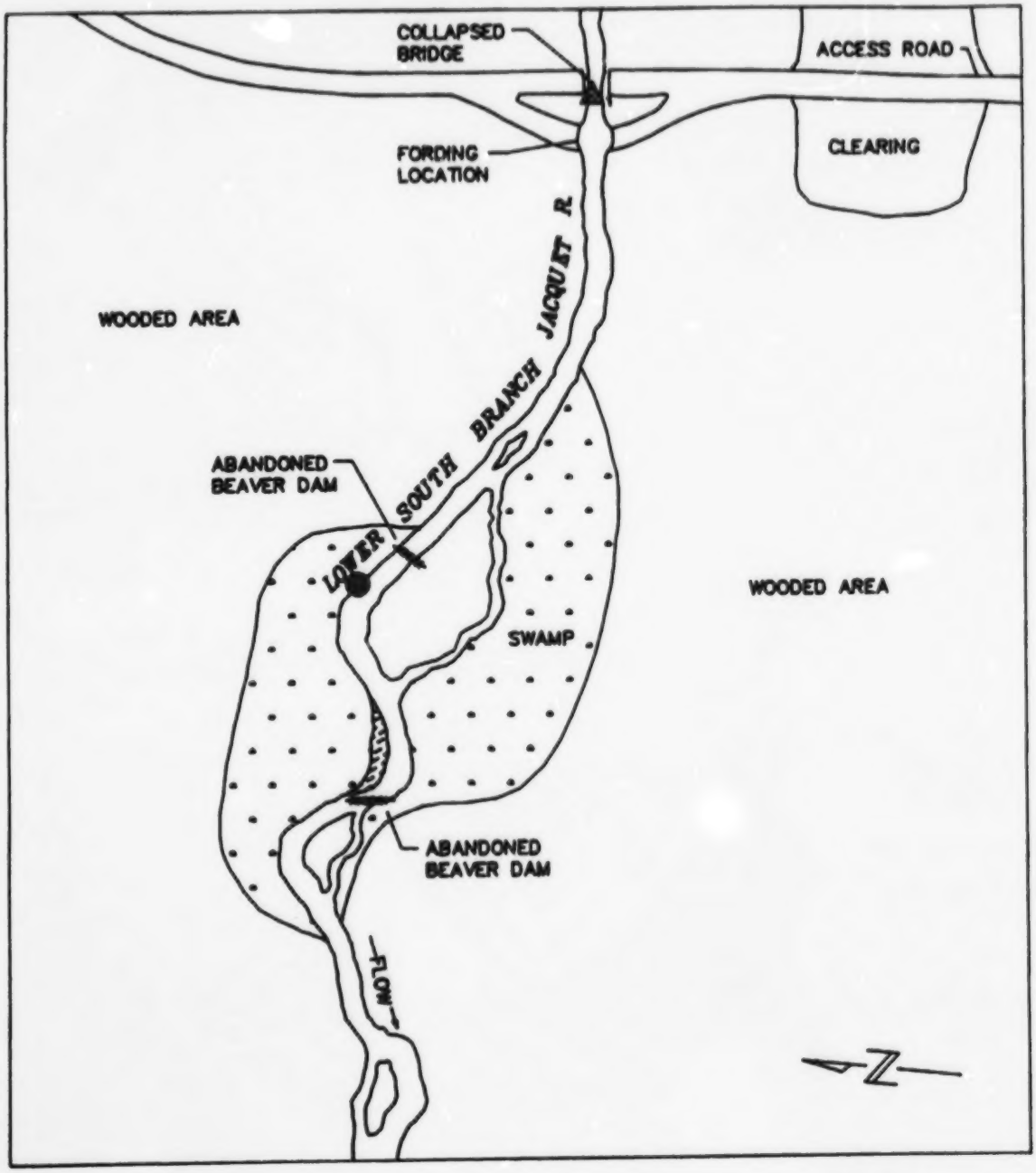
- A_2 WATER CHEMISTRY SAMPLING STATION
- SEDIMENT SAMPLING STATION
- RIFFLE AREA
- POOL
- BARRIER
- GRAVEL

SCALE 0 5 m (APPROX.)
TOPOGRAPHIC MAP 21-O/16
MILITARY GRID 957 926

Table 2.6 Water and sediment analyses,
Site 7, Upper McNair Brook, August 14 , 1984

Parameter	Water Sample No.			Sediment
	1	2	3	1
Temperature (°C)	18.8			
Dissolved oxygen (mg/l)	8.0			
Conductivity (µS/cm)	61			
pH	6.8			
Turbidity (ntu.)				
Dissolved organic carbon (ppm)				
Organic carbon (mg/l)				
Carbon (mg/l)				
Moisture (%)				
Dissolved nitrogen (mg/l)				
Total nitrogen (mg/l)				
Total phosphorous (mg/l)				
Silica (mg/l)				
Iron (mg/l)				
Copper (mg/l)				
Lead (mg/l)				
Zinc (mg/l)				
Cadmium (mg/l)				
Arsenic (mg/l)				
Mercury (mg/l)				
Fenitrothion (mg/l)				

FIG. 2.8 LOCATION OF CHEMISTRY SAMPLING STATIONS, SITE 8, LOWER SOUTH BRANCH JACQUET RIVER, AUGUST 18,1984



LEGEND

- A_2 WATER CHEMISTRY SAMPLING STATION
- SEDIMENT SAMPLING STATION
- RIFFLE AREA
- POOL
- BARRIER
- GRAVEL

SCALE 0 5 10 15 m (APPROX.)
TOPOGRAPHIC MAP 21-O/9
MILITARY GRID 133 859

Table 2.7 Water and sediment analyses,
Site 8, Lower South Branch, Jacquet River, August 18, 1984.

Parameter	Water Sample No.			Sediment
	1	2	3	1
Temperature (°C)	4.4			
Dissolved oxygen (mg/l)	9.1			
Conductivity (µS/cm)	71			
pH	6.8			
Turbidity (ntu.)	3.25	3.0		
Dissolved organic carbon (mg/l)	11.0			
Organic carbon (mg/l)				81.7
Carbon (mg/l)	106.2			
Moisture (%)	26.73			
Dissolved nitrogen (mg/l)	0.21			
Total nitrogen (mg/l)	0.38			
Total phosphorous (mg/l)	0.015			
Silica (mg/l)	5.6			
Iron (mg/l)	0.324	0.304		
Copper (mg/l)	<0.001	<0.001		10.3 *
Lead (mg/l)	<0.002	<0.002	<2.0 *	
Zinc (mg/l)	0.027	0.026	98.0 *	
Cadmium (mg/l)	<0.001	<0.001	0.20 *	
Arsenic (mg/l)	0.002	<0.002		
Mercury (mg/l)	<0.025 *			
Fenitrothion (mg/l)	<0.005 *			

* - sediment analysis expressed as µg/g dry weight

FIG. 2.9 LOCATION OF CHEMISTRY SAMPLING STATIONS, SITE 9, BIG HOLE BROOK, AUGUST 17,1984

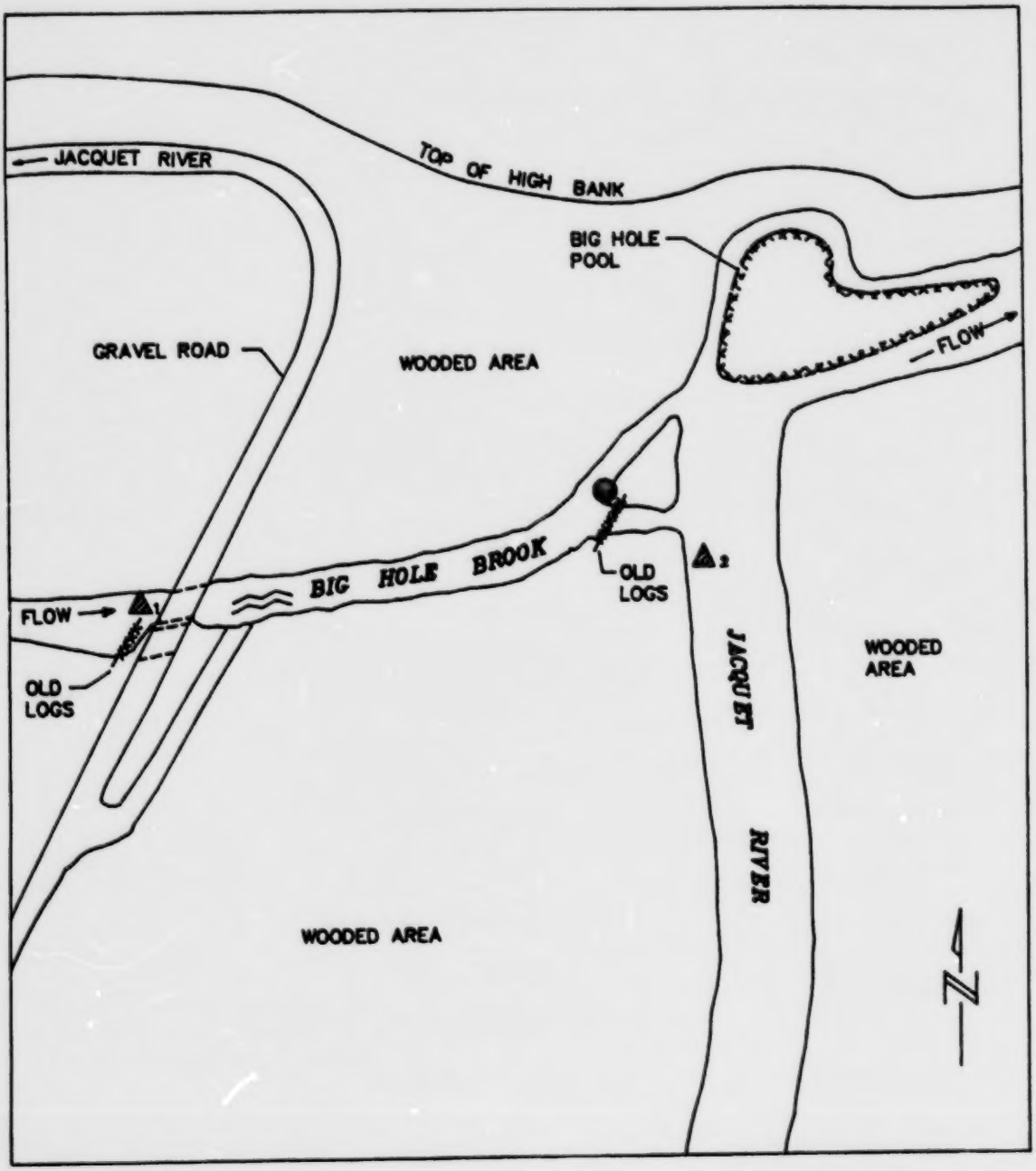


Table 2.8 Water and sediment analyses,
Site 9, Big Hole Brook, August 16, 1984

Parameter	Water Sample No.			Sediment
	1	2	3	1
Temperature (°C)	18.4	17.7	17.9	
Dissolved oxygen (mg/l)	9.3	9.6	9.3	
Conductivity (µS/cm)	90	94	93	
pH	7.4	7.4	7.4	
Turbidity (ntu.)	0.1			
Dissolved organic carbon (mg/l)	4.4			
Organic carbon (mg/l)	21.0			
Carbon (mg/l)	46.4			
Moisture (%)	2.67			
Dissolved nitrogen (mg/l)	0.09			
Total nitrogen (mg/l)	0.17			
Total phosphorous (mg/l)	0.005			
Silica (mg/l)	8.20			
Iron (mg/l)	0.052	0.040		
Copper (mg/l)	0.002	<0.001	17.1	*
Lead (mg/l)	<0.002	<0.002	<2.0	*
Zinc (mg/l)	0.215	0.032	118.0	*
Cadmium (mg/l)	<0.001	<0.001	0.2	*
Arsenic (mg/l)	<0.002	<0.002		
Mercury (mg/l)	0.04 *			
Fenitrothion (mg/l)	<0.005 *			

* - sediment analysis expressed as µg/g dry weight

FIG. 2.10 LOCATION OF CHEMISTRY SAMPLING STATIONS, SITE 10, TONGUE LAKE BROOK, AUGUST 19,1984

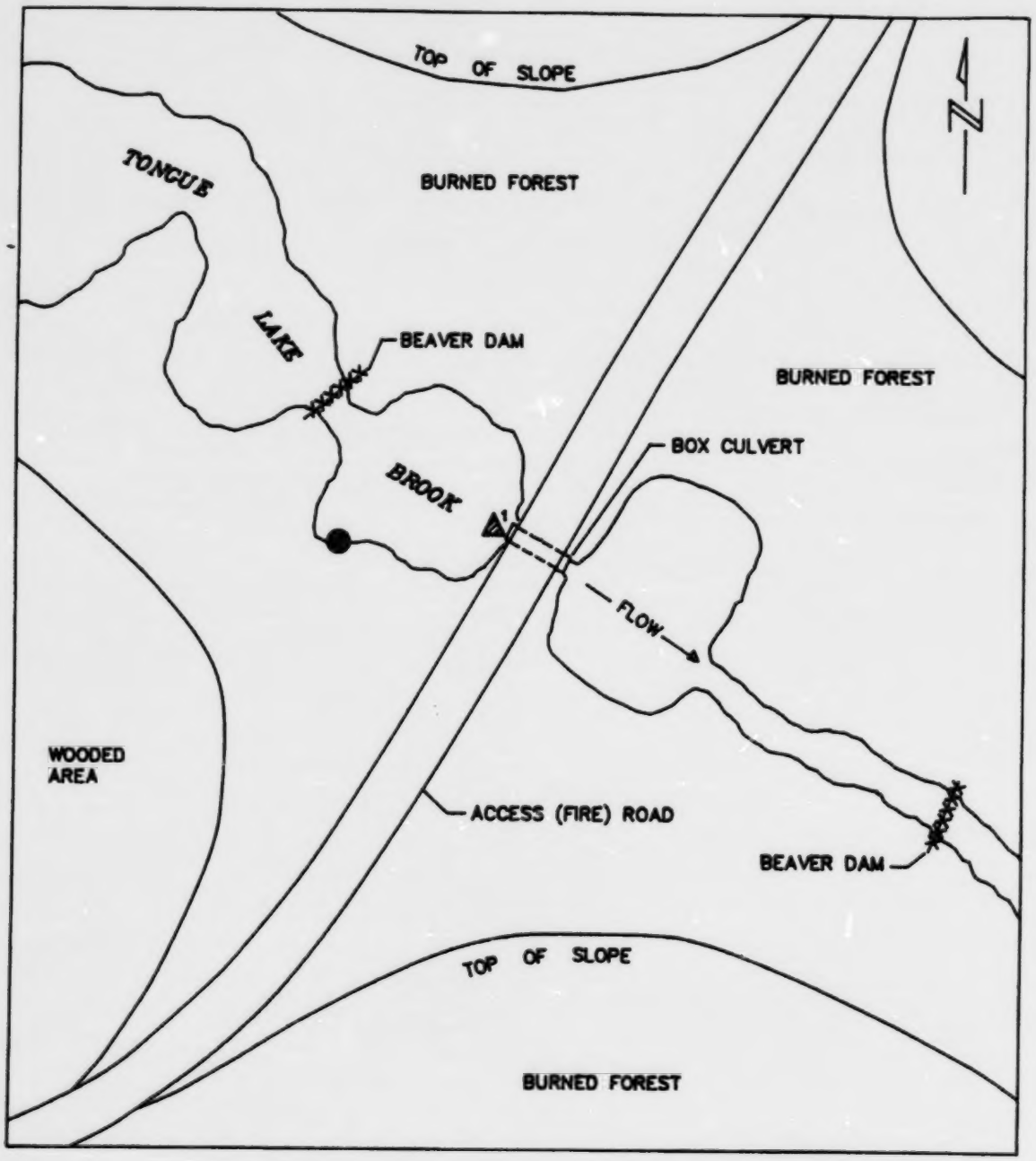


Table 2.9 Water and sediment analyses,
Site 10, Tongue Lake Brook, August 19, 1984

Parameter	Water Sample No.			Sediment
	1	2	3	1
Temperature (°C)	13.8			
Dissolved oxygen (mg/l)	8.5			
Conductivity (µS/cm)	88			
pH	6.6			
Turbidity (ntu.)	8.5			
Dissolved organic carbon (mg/l)	9.5			
Organic carbon (mg/l)	219.9			
Carbon (mg/l)	305.5			
Moisture (%)	26.92			
Dissolved nitrogen (mg/l)	0.11			
Total nitrogen (mg/l)	0.27			
Total phosphorous (mg/l)	0.014			
Silica (mg/l)	9.2			
Iron (mg/l)	0.128	0.132		
Copper (mg/l)	<0.001	<0.001	16.80 *	
Lead (mg/l)	<0.002	<0.002	<2.0 *	
Zinc (mg/l)	0.032	0.036	104.0 *	
Cadmium (mg/l)	<0.001	<0.001	0.1 *	
Arsenic (mg/l)	0.002	0.002		
Mercury (mg/l)	<0.025 *			
Fenitrothion (mg/l)	<0.005 *			

* - sediment analysis expressed as µg/g dry weight

FIG. 2.11 LOCATION OF CHEMISTRY SAMPLING STATIONS, SITE 11, HEAD LAKE, AUGUST 21,1984

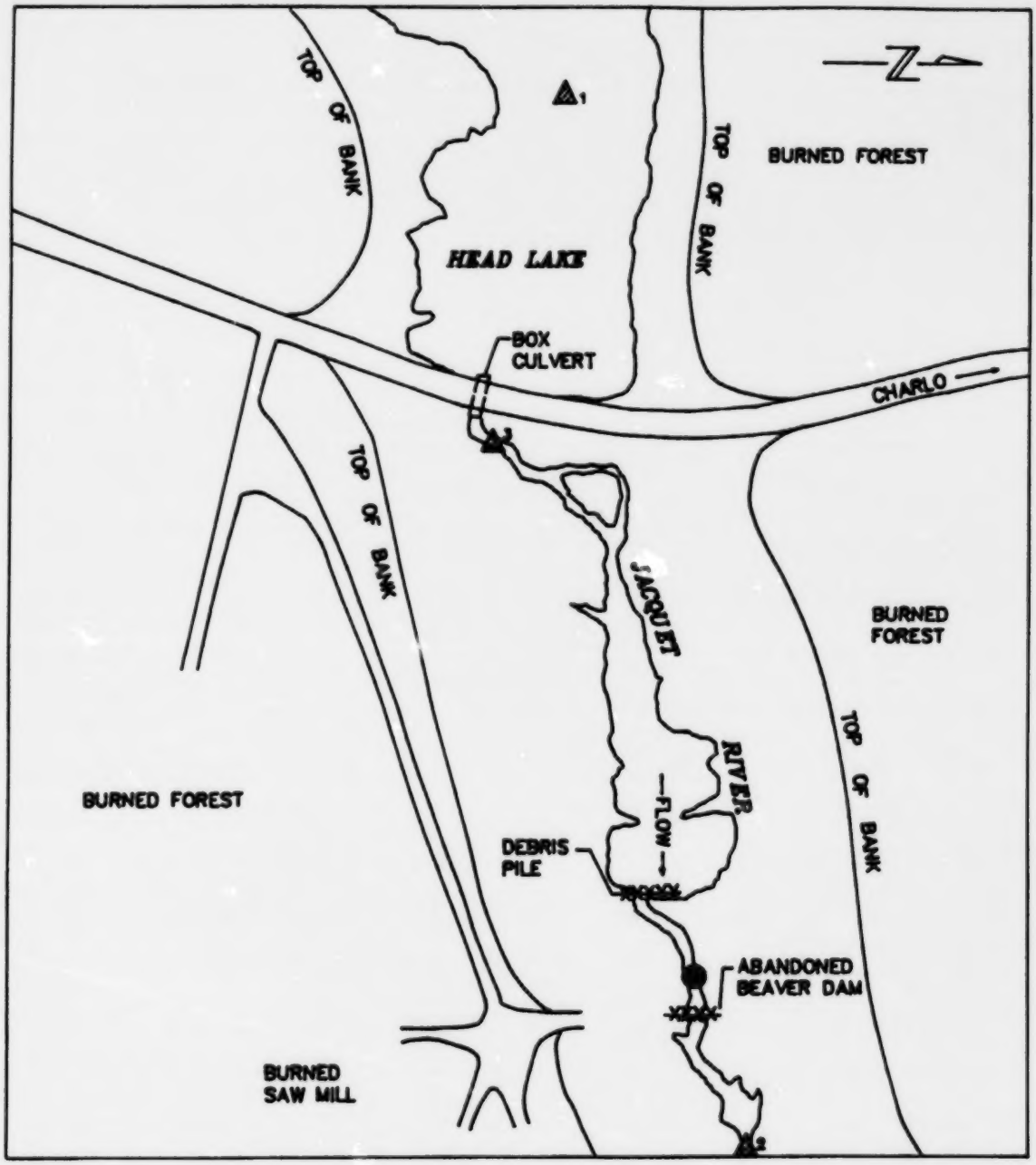
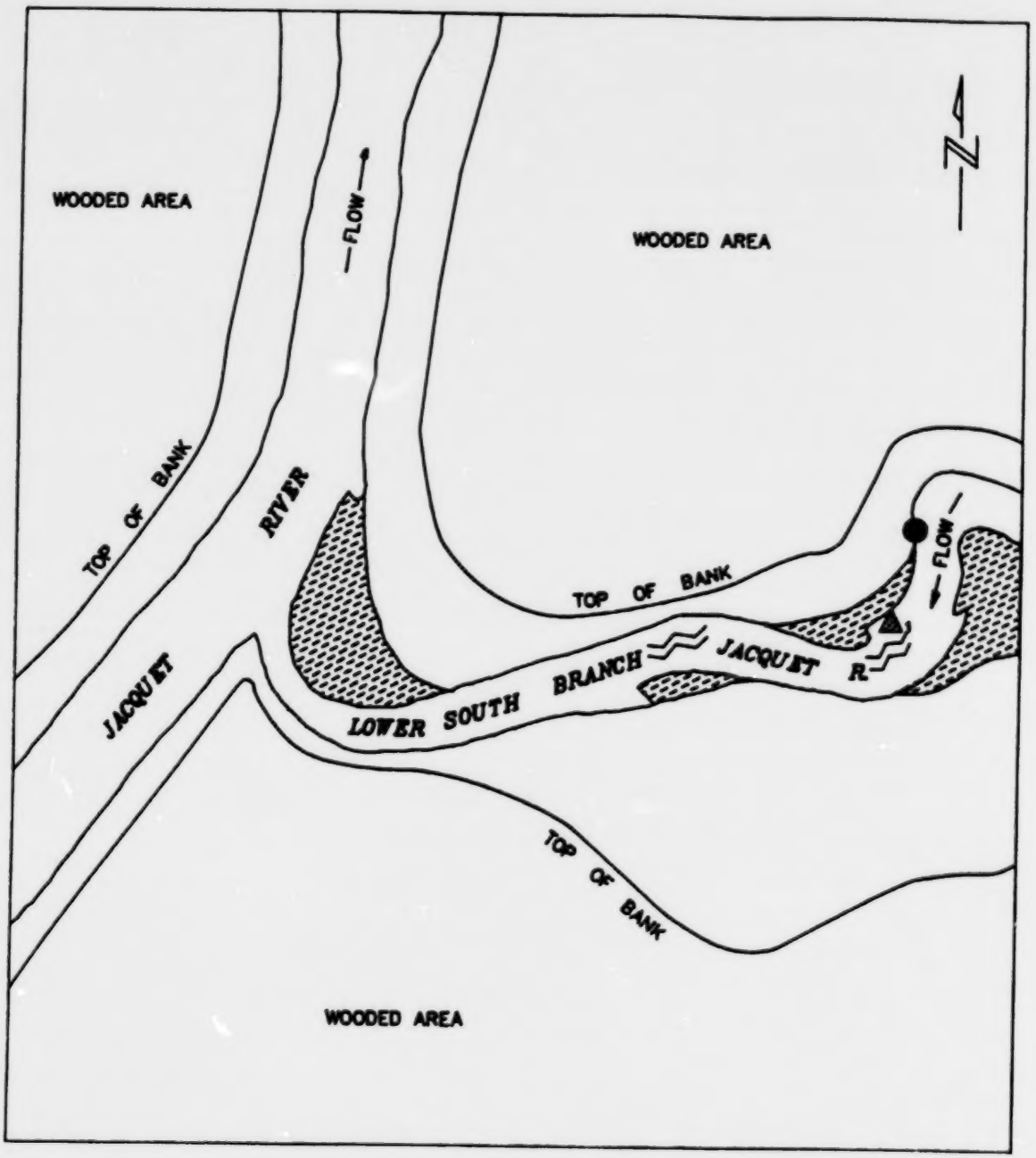


Table 2.10 Water and sediment analyses,
Site 11, Head Lake, August 21, 1984.

Parameter	Water Sample No.			Sediment
	1	2	3	1
Temperature (°C)	17.8	18.5		
Dissolved oxygen (mg/l)	7.6	7.9		
Conductivity (µS/cm)	83	90		
pH	6.7	6.7		
Turbidity (ntu.)	1.4			
Dissolved organic carbon (mg/l)	4.4			
Organic carbon (mg/l)	124.9			
Carbon (mg/l)	164.1			
Moisture (%)	25.06			
Dissolved nitrogen (mg/l)	0.02			
Total nitrogen (mg/l)	0.15			
Total phosphorous (mg/l)	0.068			
Silica (mg/l)	11.0			
Iron (mg/l)	0.066	0.112		
Copper (mg/l)	<0.001	<0.001	23.8 *	
Lead (mg/l)	<0.002	<0.002	<2.0 *	
Zinc (mg/l)	0.030	0.022	110.0 *	
Cadmium (mg/l)	<0.001	<0.001	0.2 *	
Arsenic (mg/l)	<0.002	<0.002		
Mercury (mg/l)	0.03 *			
Fenitrothion (mg/l)	<0.005 *			

* - sediment analysis expressed as µg/g dry weight

FIG. 2.12 LOCATION OF CHEMISTRY SAMPLING STATIONS, SITE 12, LOWER SOUTH BRANCH JACQUET RIVER, AUGUST 22,1984



LEGEND

- A_2 WATER CHEMISTRY SAMPLING STATION
- SEDIMENT SAMPLING STATION
- RIFFLE AREA
- POOL
- BARRIER
- GRAVEL

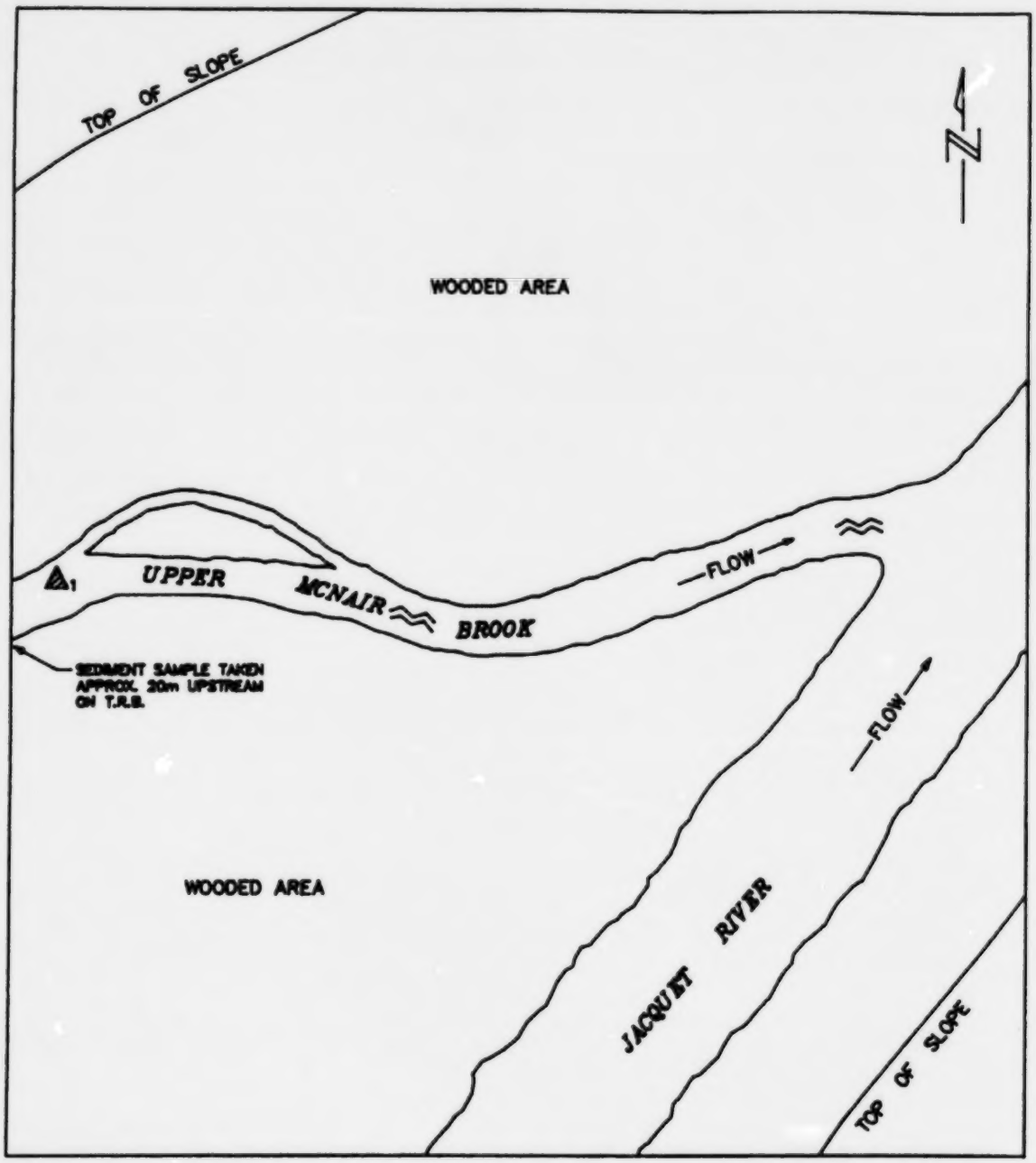
SCALE 0 10 20 m (APPROX.)
TOPOGRAPHIC MAP 21-O/16
MILITARY GRID 179 989

Table 2.11 Water and sediment analyses,
Site 12, Lower South Branch, Jacquet River, August 22, 1984.

Parameter	Water Sample No.			Sediment
	1	2	3	1
Temperature (°C)	16.6			
Dissolved oxygen (mg/l)	9.3			
Conductivity (µS/cm)	131			
pH	7.5			
Turbidity (ntu.)				
Dissolved organic carbon (mg/l)	1.6			
Organic carbon (mg/l)		28.9		
Carbon (mg/l)	54.0			
Moisture (%)		1.66		
Dissolved nitrogen (mg/l)	0.19			
Total nitrogen (mg/l)	0.16			
Total phosphorous (mg/l)	0.005			
Silica (mg/l)	5.8			
Iron (mg/l)	0.008	0.008		
Copper (mg/l)	<0.001	<0.001	23.7	*
Lead (mg/l)	<0.002	<0.002	<2.0	*
Zinc (mg/l)	0.020	0.022	95.7	*
Cadmium (mg/l)	<0.001	<0.001	0.2	*
Arsenic (mg/l)	0.002	0.002		
Mercury (mg/l)	0.09 *			
Fenitrothion (mg/l)	<0.005 *			

* - sediment analysis expressed as µg/g dry weight

FIG. 2.13 LOCATION OF CHEMISTRY SAMPLING STATIONS, SITE 13, UPPER MCNAIR BROOK, AUGUST 23,1984



LEGEND

- WATER CHEMISTRY SAMPLING STATION
- SEDIMENT SAMPLING STATION
- RIFFLE AREA
- POOL
- BARRIER
- GRAVEL

SCALE 0 5 10 15 m (APPROX.)

TOPOGRAPHIC MAP 21-O/9

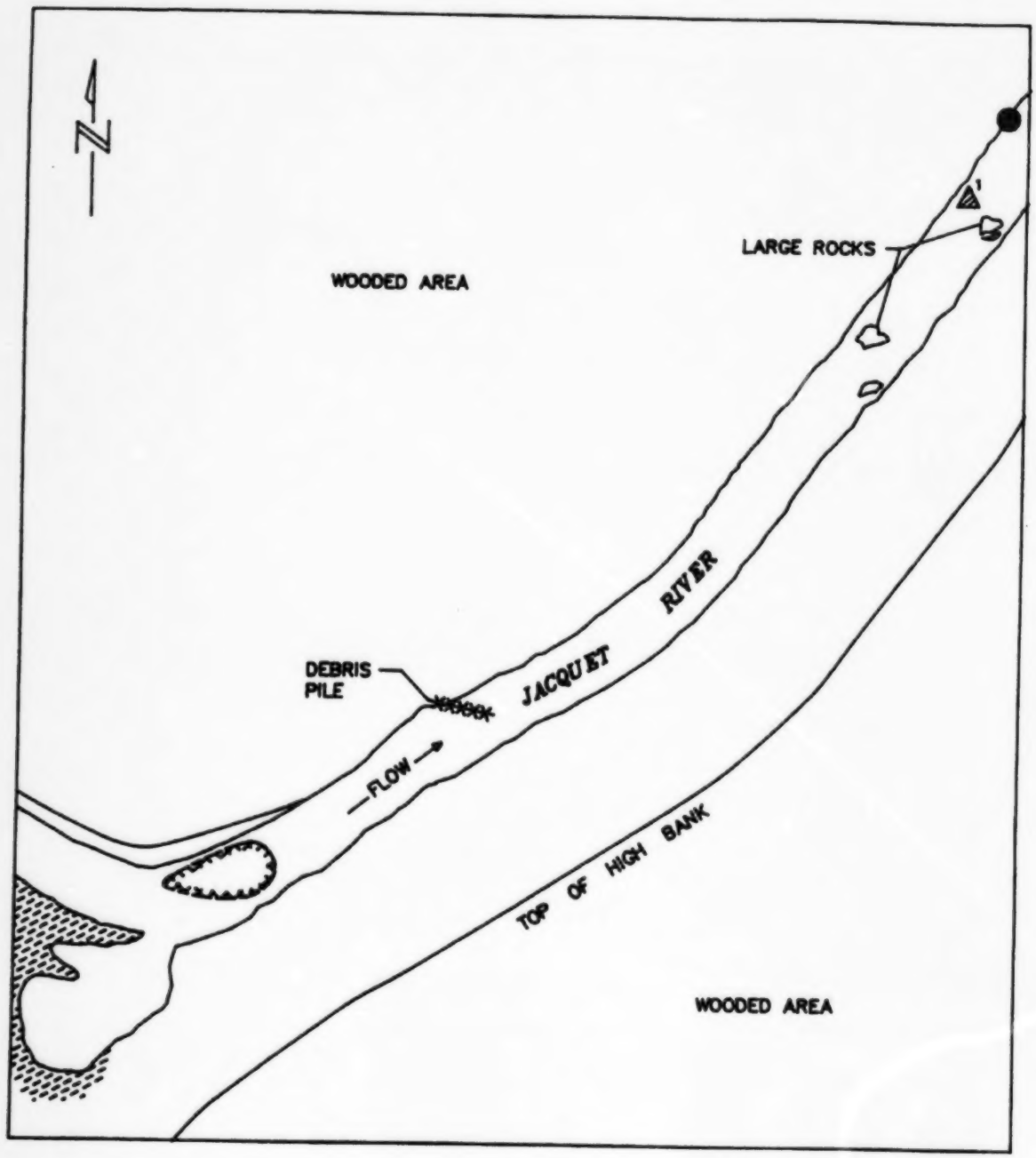
MILITARY GRID 079 901

Table 2.12 Water and sediment analyses,
Site 13, Upper McNair Brook, August 23, 1984.

Parameter	Water Sample No.			Sediment
	1	2	3	1
Temperature (°C)	11.8			
Dissolved oxygen (mg/l)	10.4			
Conductivity (µS/cm)	106			
pH	7.3			
Turbidity (ntu.)				
Dissolved organic carbon (mg/l)	2.2			
Organic carbon (mg/l)	11.0			
Carbon (mg/l)	59.6			
Moisture (%)				3.39
Dissolved nitrogen (mg/l)	0.13			
Total nitrogen (mg/l)	0.16			
Total phosphorous (mg/l)	0.004			
Silica (mg/l)	9.0			
Iron (mg/l)	0.018	0.016		
Copper (mg/l)	<0.001	<0.001	19.0	*
Lead (mg/l)	<0.002	<0.002	18.6	*
Zinc (mg/l)	0.027	0.021	224.0	*
Cadmium (mg/l)	<0.001	<0.001	0.4	*
Arsenic (mg/l)	<0.002	0.002		
Mercury (mg/l)	0.05 *			
Fenitrothion (mg/l)	<0.005 *			

* - sediment analysis expressed as µg/g dry weight

FIG. 2.14 LOCATION OF CHEMISTRY SAMPLING STATIONS, SITE 14, JACQUET RIVER, AUGUST 23,1984



LEGEND

- A_2 WATER CHEMISTRY SAMPLING STATION
- SEDIMENT SAMPLING STATION
- RIFFLE AREA
- POOL
- BARRIER
- GRAVEL

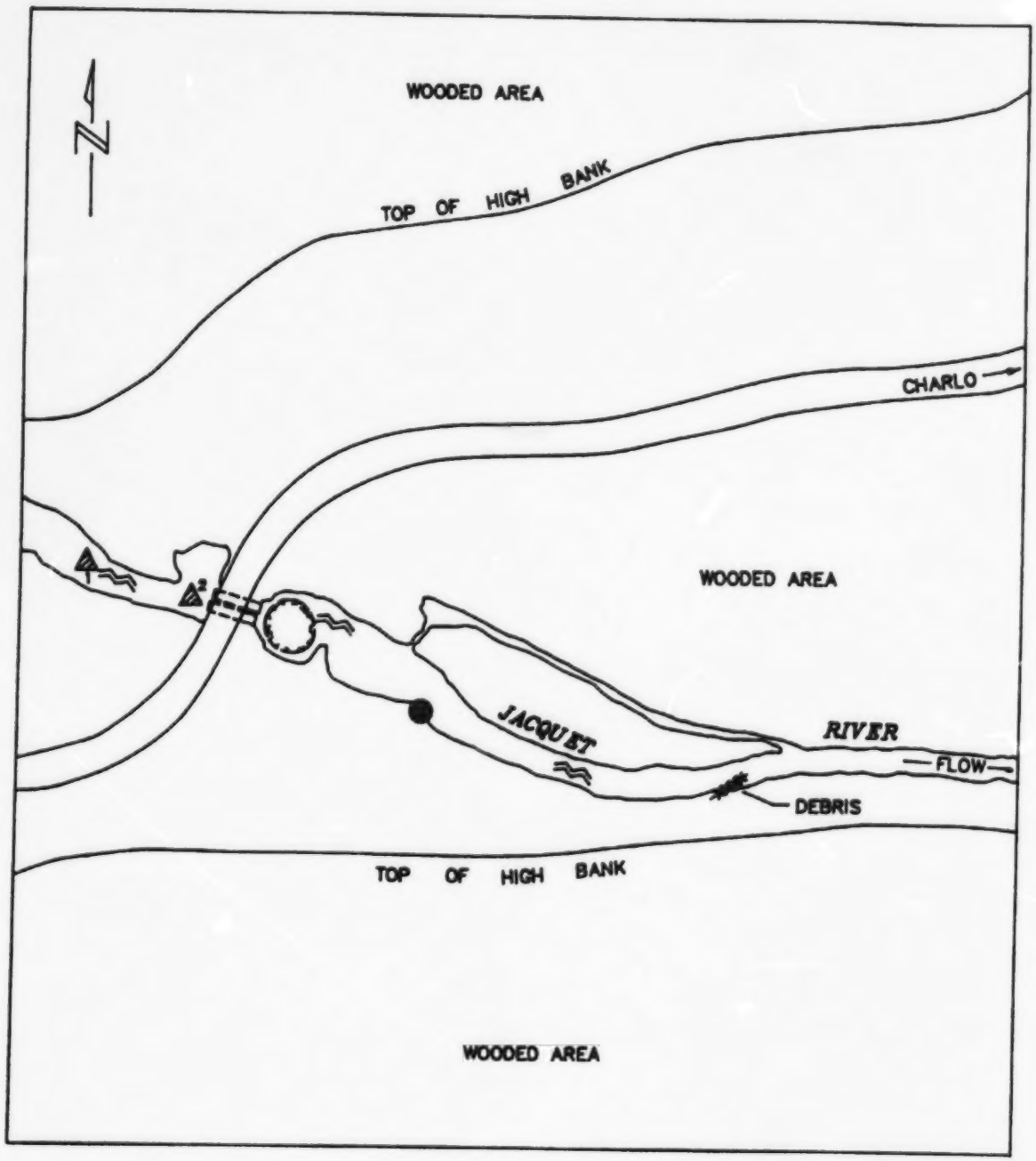
SCALE 0 10 20 m (APPROX.)
TOPOGRAPHIC MAP 21-O/9
MILITARY GRID 079 900

Table 2.13 Water and sediment analyses,
Site 14, Jacquet River, August 23, 1984.

Parameter	Water Sample No.			Sediment
	1	2	3	1
Temperature (°C)	13.2	12.2		
Dissolved oxygen (mg/l)	9.8	10.1		
Conductivity (µS/cm)	89	104		
pH	7.2	7.3		
Turbidity (ntu.)				
Dissolved organic carbon (mg/l)	3.8			
Organic carbon (mg/l)	21.3			
Carbon (mg/l)	42.7			
Moisture (mg/l)	2.34			
Dissolved nitrogen (mg/l)	0.11			
Total nitrogen (mg/l)	0.16			
Total phosphorous (mg/l)	0.005			
Silica (mg/l)	9.2			
Iron (mg/l)	0.036	0.034		
Copper (mg/l)	0.001	0.001	14.8 *	
Lead (mg/l)	0.002	0.002	2.0 *	
Zinc (mg/l)	0.022	0.021	113.0 *	
Cadmium (mg/l)	0.001	0.001	0.2 *	
Arsenic (mg/l)	0.002	0.002		
Mercury (mg/l)	0.04 *			
Fenitrothion (mg/l)	0.005 *			

* - sediment analysis expressed as µg/g dry weight

FIG. 2.15 LOCATION OF CHEMISTRY SAMPLING STATIONS, SITE 15, JACQUET RIVER, AUGUST 25,1984



LEGEND

- $\triangle_2$ WATER CHEMISTRY SAMPLING STATION
- ● SEDIMENT SAMPLING STATION
- RIFFLE AREA
- POOL
- BARRIER
- GRAVEL

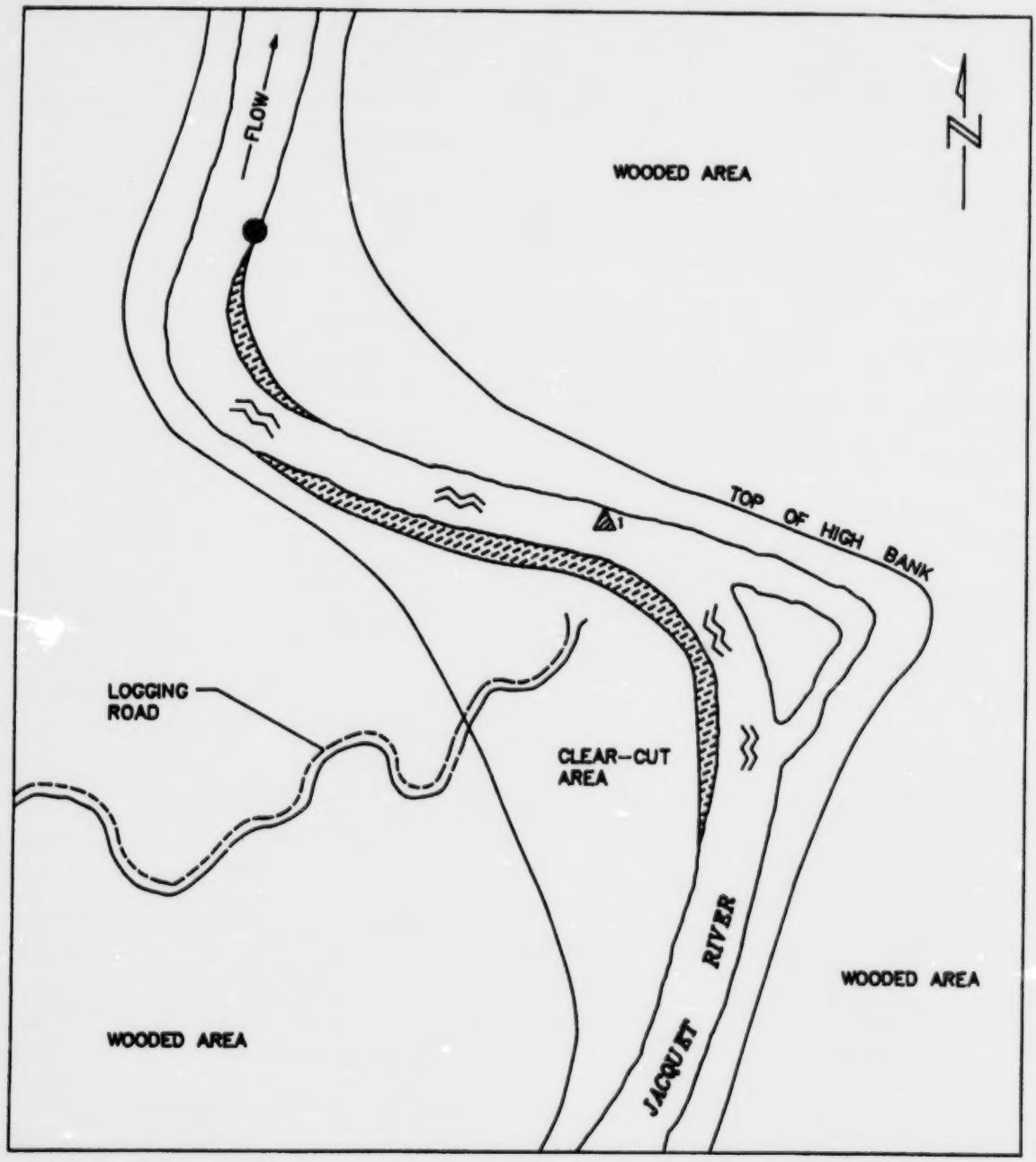
SCALE 0 10 20 m (APPROX.)
TOPOGRAPHIC MAP 21-O/9
MILITARY GRID 976 827

Table 2.14 Water and sediment analyses,
Site 15, Jacquet River, August 25, 1984.

Parameter	Water Sample No.			Sediment
	1	2	3	1
Temperature (°C)	13.5	13.4		
Dissolved oxygen (mg/l)	9.6	9.6		
Conductivity (µS/cm)	90	90		
pH	7.3	7.2		
Turbidity (ntu.)	0.3			
Dissolved organic carbon (mg/l)	3.4			
Organic carbon (mg/l)	105.0			
Carbon (g/kg)	194.7			
Moisture (%)	10.49			
Dissolved nitrogen (mg/l)	<0.01			
Total nitrogen (mg/l)	0.1			
Total phosphorous (mg/l)	0.015			
Silica (mg/l)	12.0			
Iron (mg/l)				
Copper (mg/l)	17.8 *			
Lead (mg/l)	<2.0 *			
Zinc (mg/l)	71.6 *			
Cadmium (mg/l)	0.2 *			
Arsenic (mg/l)				
Mercury (mg/l)	0.05 *			
Fenitrothion (mg/l)	<0.005 *			

* - sediment analysis expressed as µg/g dry weight

FIG. 2.16 LOCATION OF CHEMISTRY SAMPLING STATIONS, SITE 16, JACQUET RIVER, AUGUST 26,1984



LEGEND

- 2 — WATER CHEMISTRY SAMPLING STATION
- SEDIMENT SAMPLING STATION
- RIFFLE AREA
- POOL
- BARRIER
- GRAVEL

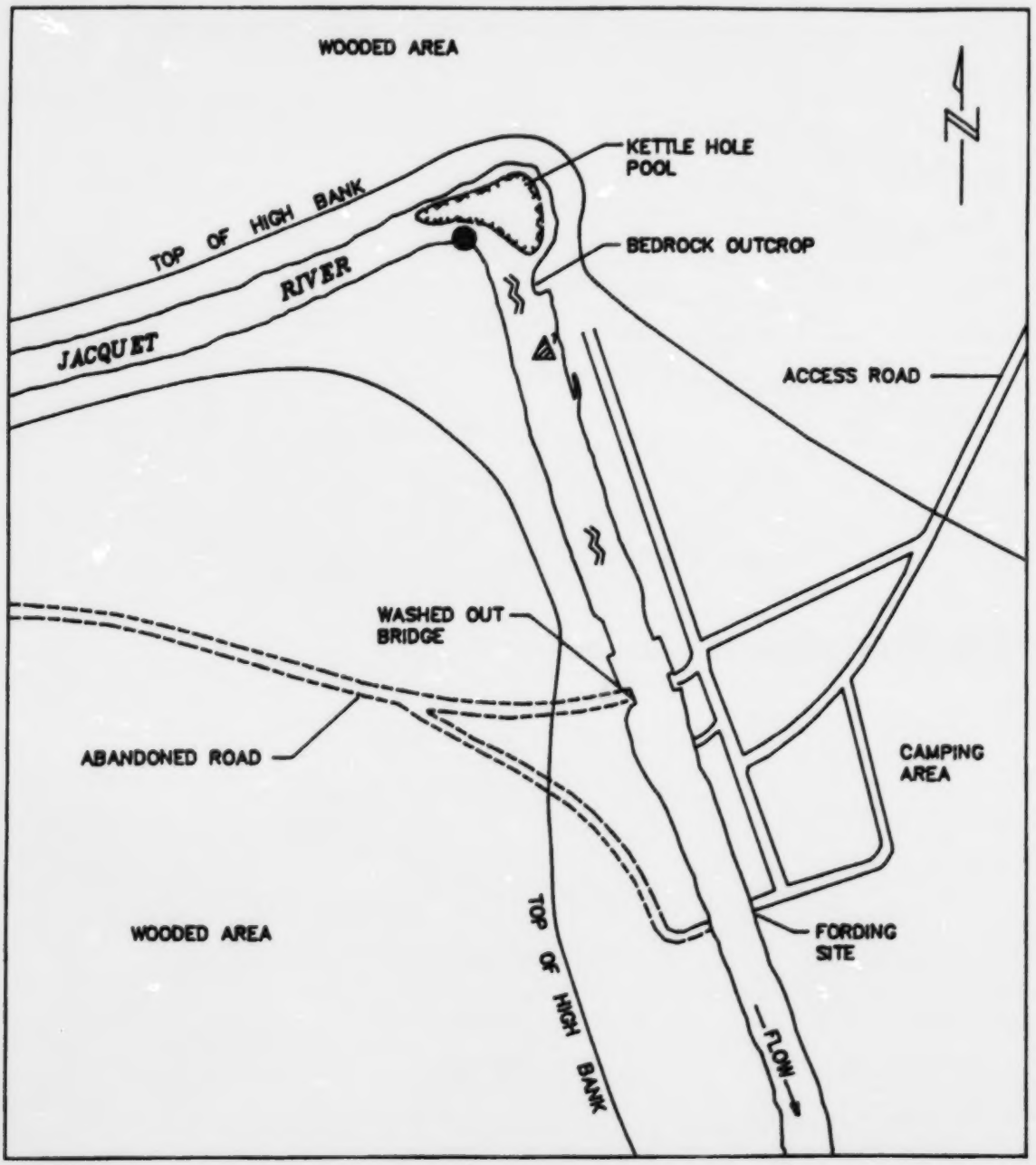
SCALE 0 20 40 m (APPROX.)
TOPOGRAPHIC MAP 21-O/16
MILITARY GRID 226 057

Table 2.15 Water and sediment analyses,
Site 16, Jacquet River, August 26, 1984.

Parameter	Water Sample No.		Sediment
	2	3	1
Temperature (°C)	15.2		
Dissolved oxygen (mg/l)	10.2		
Conductivity (µS/cm)	102		
pH	7.4		
Turbidity (ntu.)			
Dissolved organic carbon (mg/l)	2.9		
Organic carbon (mg/l)		22.6	
Carbon (mg/l)	59.8		
Moisture (%)	0.93		
Dissolved nitrogen (mg/l)	0.10		
Total nitrogen (mg/l)	0.15		
Total phosphorous (mg/l)	0.001		
Silica (mg/l)	7.5		
Iron (mg/l)	0.024	0.024	
Copper (mg/l)	<0.001	<0.001	18.2 *
Lead (mg/l)	0.002	0.003	<2.0 *
Zinc (mg/l)	0.029	0.024	128.0 *
Cadmium (mg/l)	<0.001	<0.001	0.1 *
Arsenic (mg/l)	<0.002	0.002	
Mercury (mg/l)	0.05 *		
Fenitrothion (mg/l)		<0.005 *	

* - sediment analysis expressed as µg/g dry weight

FIG. 2.17 LOCATION OF CHEMISTRY SAMPLING STATIONS, SITE 17, JACQUET RIVER, AUGUST 27,1984



LEGEND

- $\triangle_2$ WATER CHEMISTRY SAMPLING STATION
- ● SEDIMENT SAMPLING STATION
- RIFFLE AREA
- POOL
- BARRIER
- GRAVEL

SCALE 0 20 40 60 m (APPROX.)

TOPOGRAPHIC MAP 21-O/16

MILITARY GRID 153 951

Table 2.16 Water and sediment analyses,
Site 17, Jacquet River, August 27, 1984.

Parameter	Water Sample No.			Sediment
	1	2	3	1
Temperature (°C)	14.9			
Dissolved oxygen (mg/l)	9.8			
Conductivity (µS/cm)	97			
pH	7.5			
Turbidity (ntu.)				
Dissolved organic carbon (mg/l)	2.6			
Organic carbon (mg/l)	24.9			
Carbon (mg/l)	47.6			
Moisture (%)		1.54		
Dissolved nitrogen (mg/l)	0.10			
Total nitrogen (mg/l)	0.17			
Total phosphorous (mg/l)	0.007			
Silica (mg/l)	8.3			
Iron (mg/l)	0.018	0.016		
Copper (mg/l)	<0.001	<0.001	16.7 *	
Lead (mg/l)	0.002	0.003	<2.0 *	
Zinc (mg/l)	0.022	0.023	136.0 *	
Cadmium (mg/l)	<0.001	<0.001	0.2 *	
Arsenic (mg/l)	<0.002	<0.002		
Mercury (mg/l)	0.03 *			
Fenitrothion (mg/l)	<0.005 *			

* - sediment analysis expressed as µg/g dry weight

FIG. 2.18 LOCATION OF CHEMISTRY SAMPLING STATIONS, SITE 18, UPPER SOUTH BRANCH JACQUET RIVER, AUGUST 28,1984

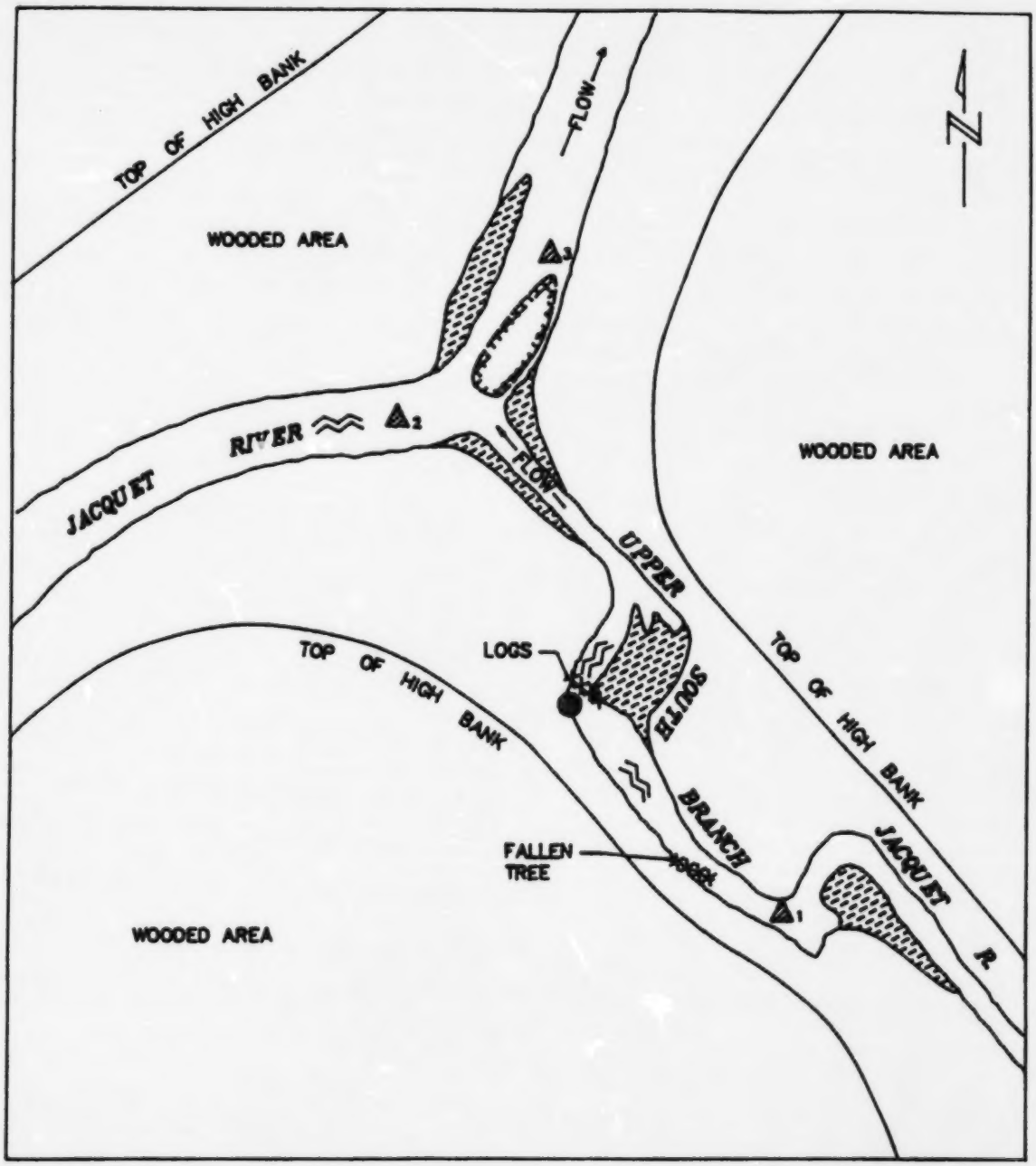


Table 2.17 Water and sediment analyses,
Site 18, Upper South Branch, Jacquet River, August 28, 1984.

Parameter	Water Sample No.			Sediment
	1	2	3	1
Temperature (°C)	13.2	12.8	13.0	
Dissolved oxygen (mg/l)	9.1	9.9	10.0	
Conductivity (µS/cm)	89	92	95	
pH	6.8	7.1	7.0	
Turbidity (ntu.)				
Dissolved organic carbon (mg/l)	3.1			
Organic carbon (mg/l)	27.0			
Carbon (mg/l)	46.2			
Moisture (%)	2.90			
Dissolved nitrogen (mg/l)	0.08			
Total nitrogen (mg/l)	0.14			
Total phosphorous (mg/l)	0.005			
Silica (mg/l)	5.6			
Iron (mg/l)	0.008	0.008		
Copper (mg/l)	<0.001	<0.001	19.5 *	
Lead (mg/l)	0.002	0.003	<2.0 *	
Zinc (mg/l)	0.023	0.022	89.7 *	
Cadmium (mg/l)	<0.001	<0.001	0.1 *	
Arsenic (mg/l)	0.002	0.002		
Mercury (mg/l)	0.05 *			
Fenitrothion (mg/l)	<0.005 *			

* - sediment analysis expressed as µg/g dry weight

FIG. 2.19 LOCATION OF CHEMISTRY SAMPLING STATIONS, SITE 19, LOWER MCNAIR BROOK, AUGUST 28,1984

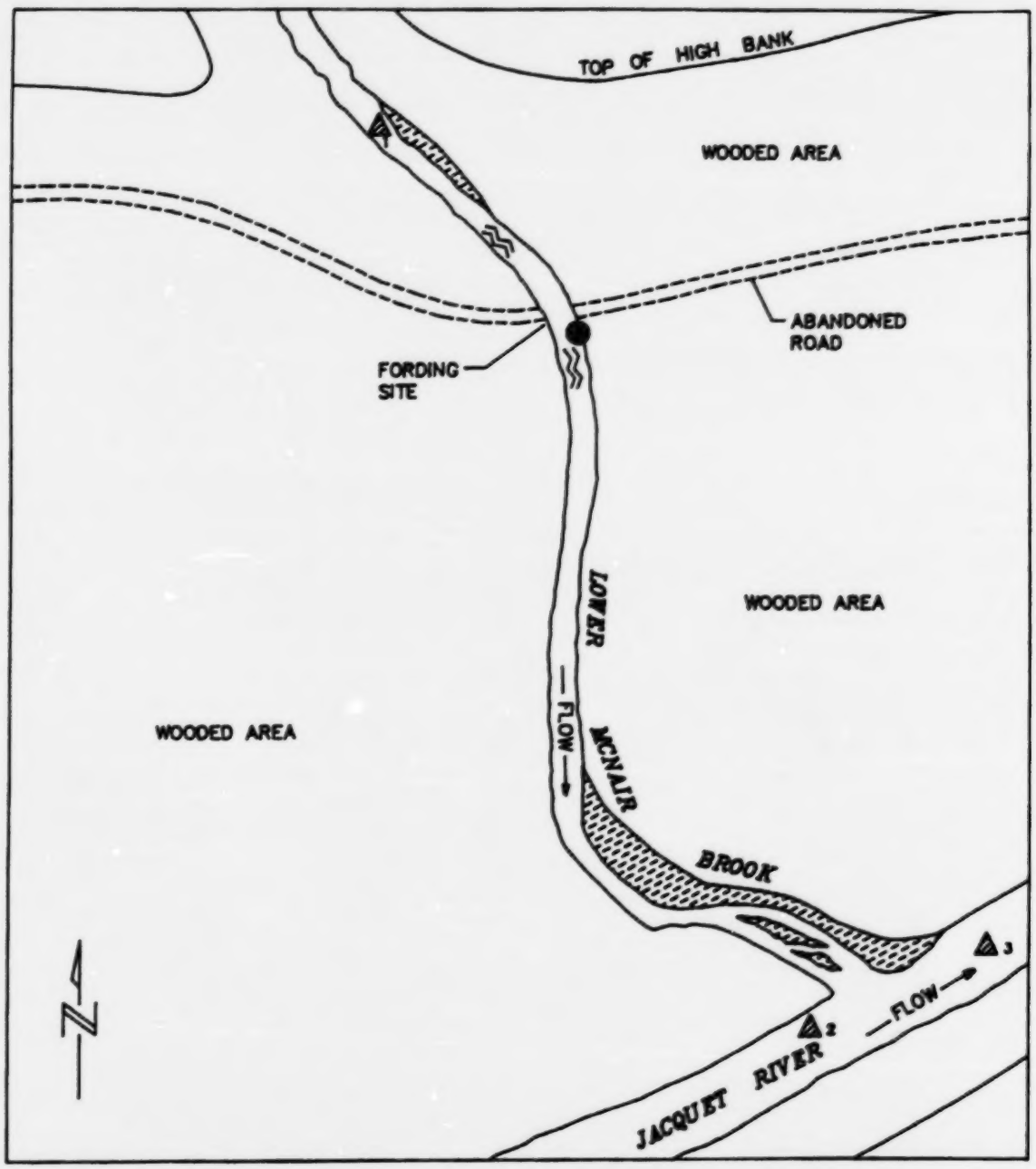
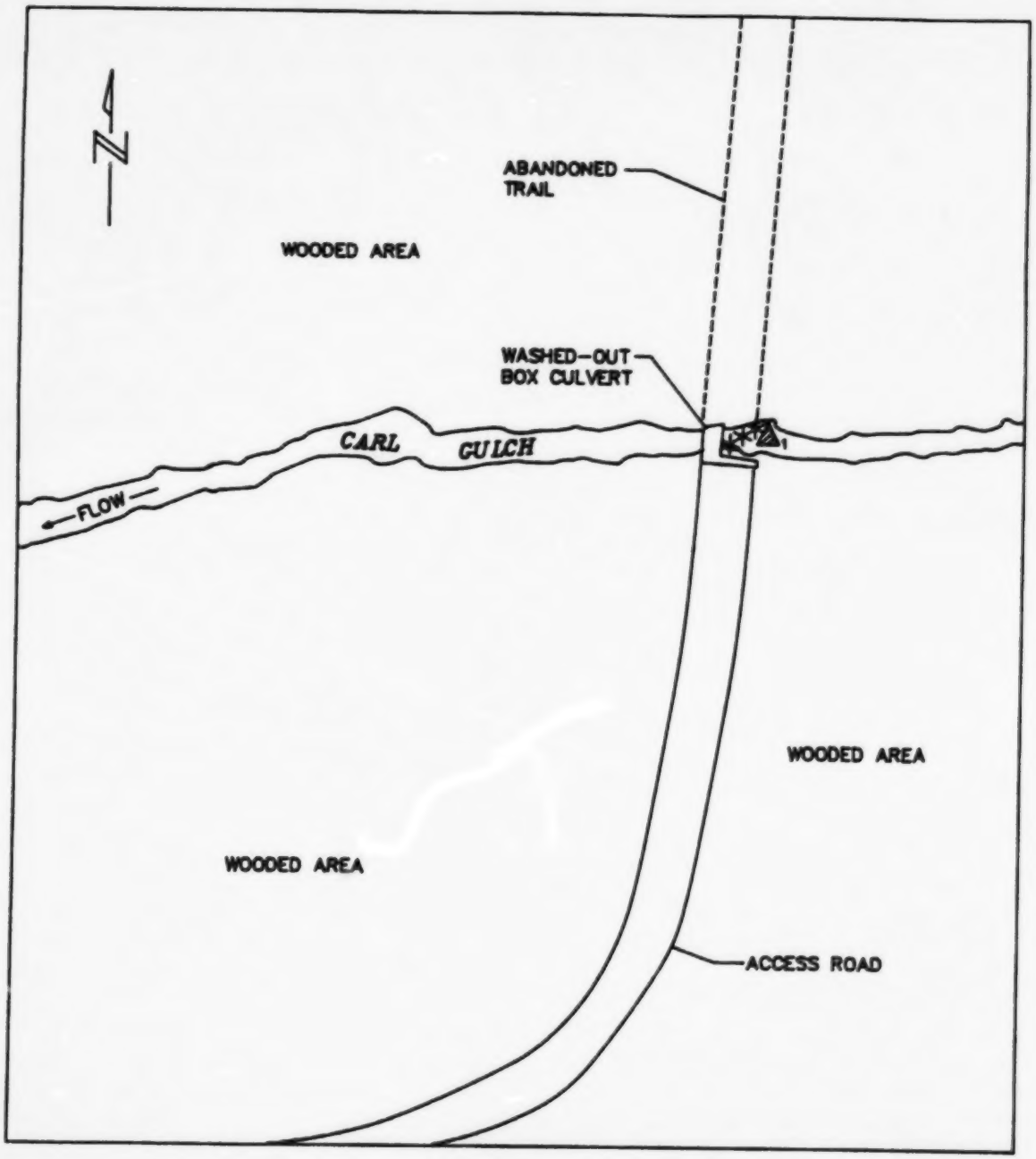


Table 2.18 Water and sediment analyses,
Site 19, Lower McNair Brook, August 28, 1984.

Parameter	Water Sample No.			Sediment
	1	2	3	1
Temperature (°C)	14.8	16.1	15.9	
Dissolved oxygen (mg/l)	9.7	10.0	8.8	
Conductivity (µS/cm)	91	97	95	
pH	7.5	7.4	7.5	
Turbidity (ntu.)				
Dissolved organic carbon (mg/l)	2.3			
Organic carbon (mg/l)	33.4			
Carbon (mg/l)	74.7			
Moisture (%)	3.83			
Dissolved nitrogen (mg/l)	0.09			
Total nitrogen (mg/l)	0.14			
Total phosphorous (mg/l)	0.006			
Silica (mg/l)	9.1			
Iron (mg/l)	0.012	0.014		
Copper (mg/l)	<0.001	<0.001	17.8 *	
Lead (mg/l)	0.003	0.004	<2.0 *	
Zinc (mg/l)	0.022	0.024	125.0 *	
Cadmium (mg/l)	<0.001	<0.001	0.2 *	
Arsenic (mg/l)	<0.002	0.002		
Mercury (mg/l)	0.08 *			
Fenitrothion (mg/l)	<0.005 *			

* - sediment analysis expressed as µg/g dry weight

FIG. 2.20 LOCATION OF CHEMISTRY SAMPLING STATIONS, SITE 20, CARL GULCH, AUGUST 29,1984



LEGEND

- $\triangle_2$ WATER CHEMISTRY SAMPLING STATION
- SEDIMENT SAMPLING STATION
- RIFFLE AREA
- POOL
- BARRIER
- GRAVEL

SCALE 0 5 10 m (APPROX.)
TOPOGRAPHIC MAP 21-0/9
MILITARY GRID 183 854

Table 2.19 Water and sediment analyses,
Site 20, Carl Gulch, August 29, 1984.

Parameter	Water Sample No.			Sediment
	1	2	3	1
Temperature (°C)	18.7			
Dissolved oxygen (mg/l)	7.6			
Conductivity (µS/cm)	60			
pH	6.4			
Turbidity (ntu.)				
Dissolved organic carbon (mg/l)	12.0			
Organic carbon (mg/l)				
Carbon (mg/l)				
Moisture (%)				
Dissolved nitrogen (mg/l)	0.11			
Total nitrogen (mg/l)	0.31			
Total phosphorous (mg/l)	0.012			
Silica (mg/l)	6.3			
Iron (mg/l)				
Copper (mg/l)				
Lead (mg/l)				
Zinc (mg/l)				
Cadmium (mg/l)				
Arsenic (mg/l)				
Mercury (mg/l)				
Fenitrothion (mg/l)				

FIG. 2.21 LOCATION OF CHEMISTRY SAMPLING STATIONS, SITE 21, UNNAMED TRIBUTARY TO UPPER SOUTH BRANCH JACQUET RIVER, AUGUST 29,1984

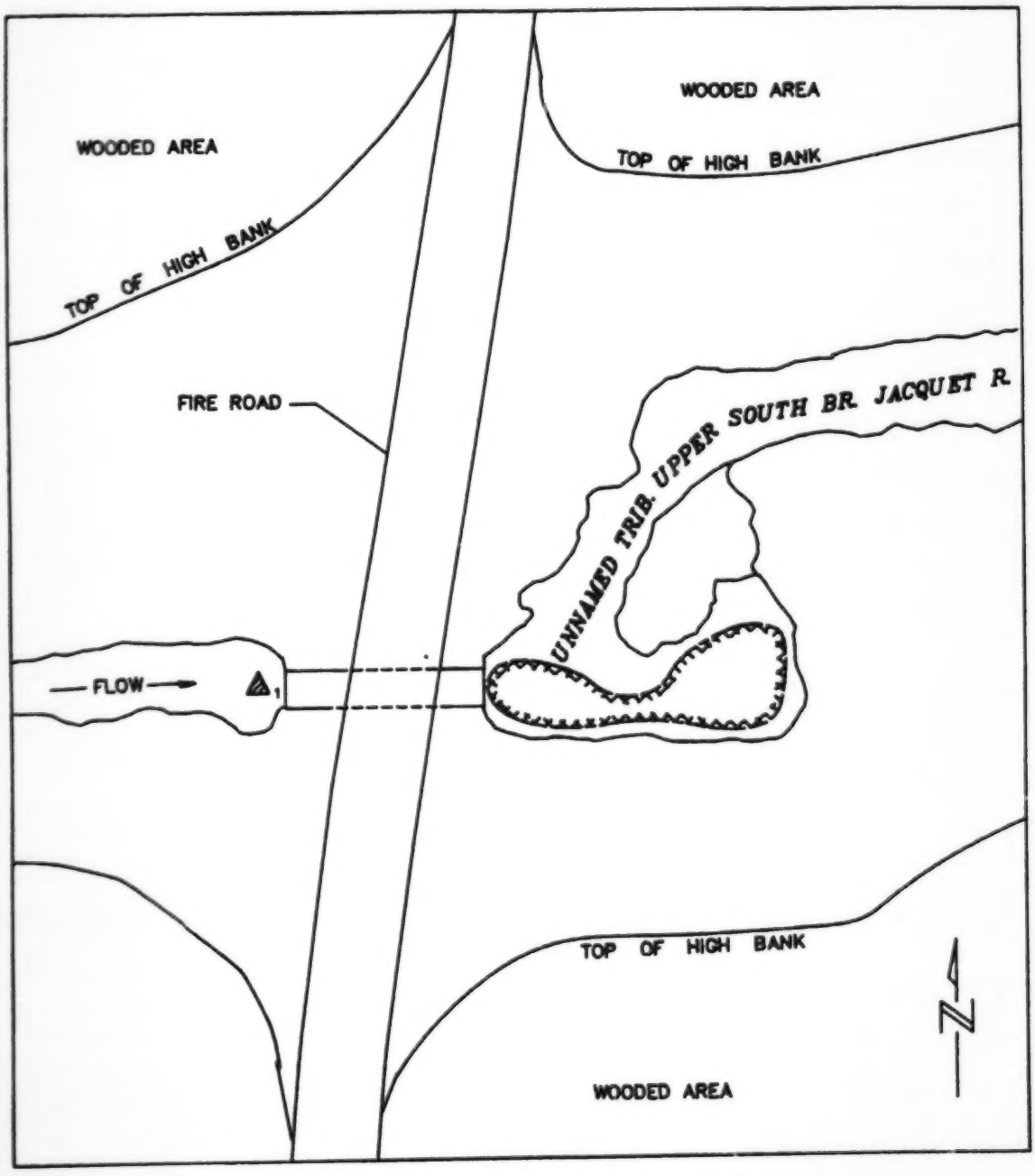
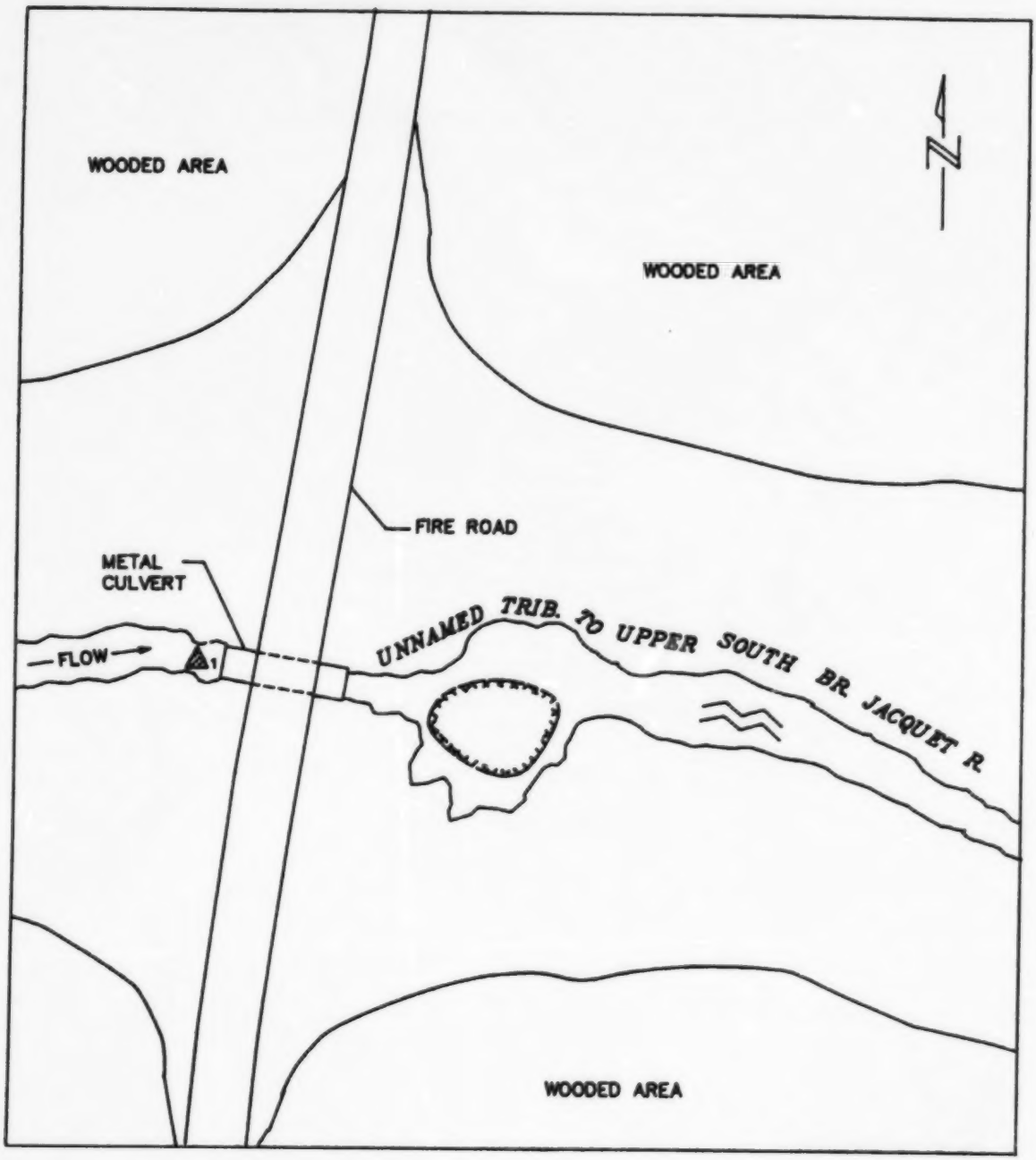


Table 2.20 Water and sediment analyses,
Site 21, Unnamed Tributary to Upper South Branch Jacquet River,
August 29, 1984.

Parameter	Water Sample No.			Sediment
	1	2	3	1
Temperature (°C)	19.7			
Dissolved oxygen (mg/l)	9.1			
Conductivity (µS/cm)	71			
pH	7.3			
Turbidity (ntu.)				
Dissolved organic carbon (mg/l)	5.1			
Organic carbon (mg/l)				
Carbon (mg/l)				
Moisture (%)				
Dissolved nitrogen (mg/l)	0.04			
Total nitrogen (mg/l)	0.14			
Total phosphorous (mg/l)	0.008			
Silica (mg/l)	5.4			
Iron (mg/l)				
Copper (mg/l)				
Lead (mg/l)				
Zinc (mg/l)				
Cadmium (mg/l)				
Arsenic (mg/l)				
Mercury (mg/l)				
Fenitrothion (mg/l)				

FIG. 2.22 LOCATION OF CHEMISTRY SAMPLING STATIONS, SITE 22, UNNAMED TRIBUTARY TO UPPER SOUTH BRANCH JACQUET RIVER, AUGUST 29,1984



LEGEND

- 2 — WATER CHEMISTRY SAMPLING STATION
- SEDIMENT SAMPLING STATION
- RIFFLE AREA
- POOL
- BARRIER
- GRAVEL

SCALE 0 5 10 m (APPROX.)
TOPOGRAPHIC MAP 21-O/9
MILITARY GRID 088 859

Table 2.21 Water and sediment analyses,
Site 22, Unnamed Tributary to Upper South Branch Jacquet River,
August 29, 1984.

Parameter	Water Sample No.			Sediment
	1	2	3	1
Temperature (°C)	19.1			
Dissolved oxygen (mg/l)	8.6			
Conductivity (µS/cm)	83			
pH	7.1			
Turbidity (ntu.)				
Dissolved organic carbon (mg/l)	4.30			
Organic carbon (mg/l)				
Carbon (mg/l)				
Moisture (%)				
Dissolved nitrogen (mg/l)	0.03			
Total nitrogen (mg/l)	0.12			
Total phosphorous (mg/l)	0.006			
Silica (mg/l)	5.2			
Iron (mg/l)				
Copper (mg/l)				
Lead (mg/l)				
Zinc (mg/l)				
Cadmium (mg/l)				
Arsenic (mg/l)				
Mercury (mg/l)				
Fenitrothion (mg/l)				

FIG. 2.23 LOCATION OF CHEMISTRY SAMPLING STATIONS, SITE 24, JACQUET RIVER, AUGUST 30,1984

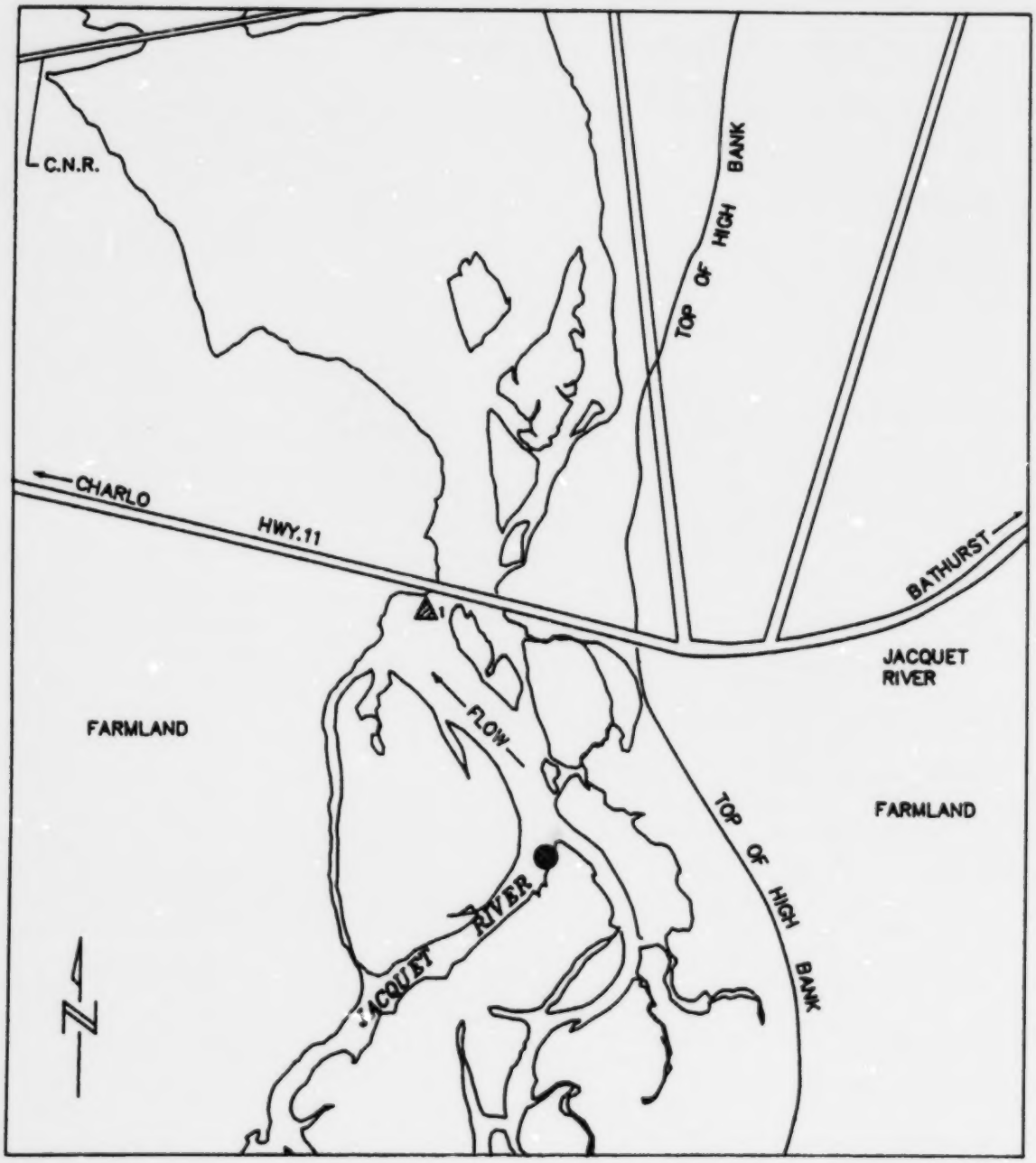


Table 2.22 Water and sediment analyses,
Site 24, Estuary, August 24, 1984.

Parameter	Water Sample No.			Sediment
	1	2	3	1
Temperature (°C)				
Dissolved oxygen (mg/l)				
Conductivity (µS/cm)				
pH				
Turbidity (ntu.)				
Dissolved organic carbon (mg/l)				
Organic Carbon (g/kg)	53.0			
Carbon (mg/l)		87.1		
Moisture (%)		6.33		
Dissolved nitrogen (mg/l)				
Total nitrogen (mg/l)				
Total phosphorous (mg/l)				
Silica (mg/l)				
Iron (mg/l)				
Copper (mg/l)	15.9 *			
Lead (mg/l)	<2.0 *			
Zinc (mg/l)	99.3 *			
Cadmium (mg/l)	0.2 *			
Arsenic (mg/l)				
Mercury (mg/l)				0.05 *
Fenitrothion (mg/l)	<0.005 *			

* - sediment analysis expressed as µg/g dry weight